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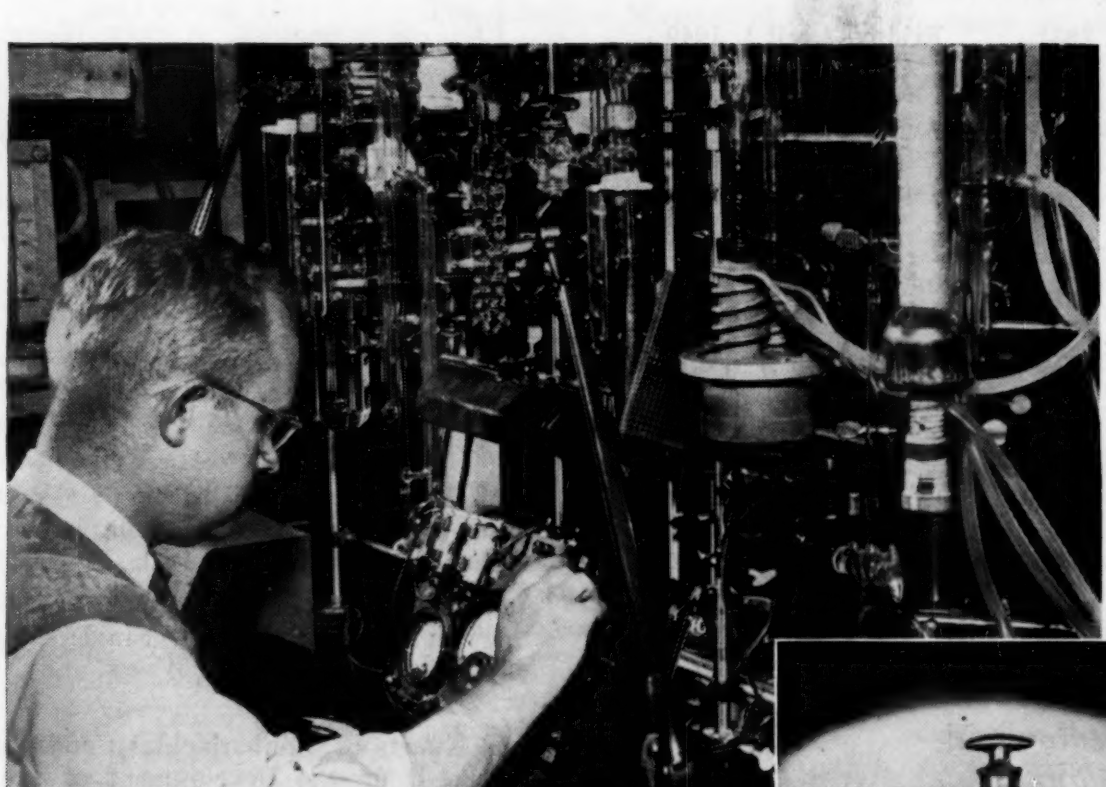

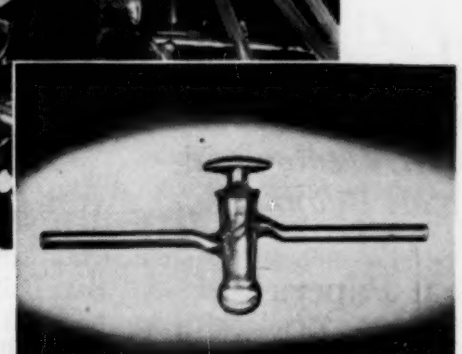

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The Responsibility of the Anthropologist

Harry L. Shapiro

American Museum of Natural History, New York City

TWENTY-FIVE YEARS AGO the number of professional anthropologists in this country was so small that the Anthropological Association at its 1922 meeting at Cambridge was comfortably seated in its entirety, along with guests and undergraduates, in one of the classrooms of the Peabody Museum.

In those antediluvian days, anthropology in the academic hierarchy was rated an exotic and marginal subject and at Harvard, at any rate, where I was doing my graduate work, it was relegated with the Semitic Museum and the Divinity School to the fringes of the University. Lacrosse and fencing occupied somewhat the same place in athletics—that is, they were considered nice extras to attract the few nonconforming spirits that did not find the more important football or track to their taste. Anthropology was not expected to pay its way, but also it was not permitted to place a noticeable strain on the university budget.

The literate public was, of course, no better acquainted with the subject. All of us had our hands full trying to explain to our friends and relatives just what anthropology meant. I remember my mother reporting with much amusement a conversation with a friend of hers who had politely inquired concerning my activities. My mother told her I was studying anthropology. "How nice," the friend commented, and, after a pause, "Just what is anthropology?" Those were the days when an ethnologist studied primitive cultures and personality was something you wished you had.

We were few and neglected, beggars for crumbs at the foundational banquets where the seated guests were physicists, chemists, biologists and economists and all the other anointed. We pursued our tasks in obscurity and our lines were heard only by our fellow anthropologists. Under these circumstances the problem of social responsibility was not very pressing. We could manipulate our data, elaborate theories, and speculate to even fantastic limits, without, as we thought, serious consequences. Since the general public was hardly aware of us except as purveyors of bizarre and exotic items about remote peoples on the verge of extinction, the accuracy of our reportage was never questioned. In those days we were not trouble shooters for the government, so that our ideas survived unharmed by use. Nor were we then tempted, even bedeviled, with huge sums to test the power of our peculiar methods to unlock the secrets of why our allies and our enemies behave the way they do. This was, in Edith Wharton's phrase, anthropology's "Age of Innocence." We had, moreover, a curiously ambivalent attitude toward society. We felt emancipated from the forms and restrictions of our own culture, delighting in exposing their irrationality. It did not, for example, seem inconsistent for us to reject the rites and ceremonies of the Christian churches and to have little or no understanding of those who remained faithful to their traditions, and at the same time be able to enter sympathetically into every minutia of a tribal ritual and theorize on its functional necessity in a social organization. I suspect that basically we were playing intellectually with data and lacked any real appreciation that ideas as such can be powerful forces in the world, both for good and for evil. We had neither the responsibility that comes from dealing with ideas in action nor the caution engendered by experimental procedures.

Although at the time we were scarcely conscious of it, we had, nevertheless, been toying with dynamite. As I think back to some of the technical lectures and writings on race professional anthropologists made at that time, I am appalled. Most anthropologists who then and earlier busied themselves with racial problems regarded their activities, I am sure, as interesting but of no major concern to the course of nations or the welfare of millions of people. I am not accusing anthropologists of directly fathering Nazi doctrine, but there can nevertheless be no doubt that anthropological generalizations on race underlay the racist notions that mushroomed in the 1930's. Anthropologists had unwittingly prepared the way for the Huston Stewart Chamberlains, the H. F. K. Gunthers, and the Madison Grants. If these writers were not entirely approved of, neither were their doctrines altogether discarded. After the damage was done and the Frankenstein monster was abroad in the world, anthropologists did their small best to make amends—but it was too late. Only Boas saw early and clearly the horrible consequences of the popular adoption of these racist speculations—innocuous in

the academic hall, but murderous in the market place. Before the evil became widely apparent, Boas' reaction was looked on as rather emotional and alarmist. Perhaps because of his European experience, he was extra sensitive to the stirring of a doctrine which meant little to most Americans. I cite this not to attach blame but to illustrate the state of mind that quite generally failed to grasp the possible consequences of current anthropological ideas in terms of social and political action.

The picture I have drawn of anthropology a generation ago has changed profoundly. Now, anthropology, if not at the head of the table, has at least a place not too far from the salt. This enlarged academic prestige can in part be measured both by the extraordinary growth of the older departments and the great increase in newer ones that are springing up all over the land. Within the generation I am describing the membership of the American Anthropological Association has increased about sixfold and the number of professionals in it from about 82 to nearly 500. If the professional standards were as liberal now as they were when I joined as a college senior our fellowship might well number a thousand.

But more significant than numbers is the quality of interest that anthropology is now able to arouse both in the general public and among professional students in other disciplines. I think the anthropologist can be permitted a pardonable satisfaction in the change of status that has lifted him from a position uncomfortably close to that of a poor relation to the more respectable place of someone with at least expectations. His stock in trade has at last begun to have value for the sociologist, the psychologist, the psychiatrist, the philosopher, and various other students of human activities.

This recent growth is only partially the result of the efforts of the anthropologists themselves. The past generation has seen a phenomenal growth in graduate study throughout the United States, resulting from the steady elevation of the national average in attained schooling. Enrollments in colleges and universities have increased far beyond the normal expectation in an increasing population. Along with other sections of the educational system, the graduate school has also flourished. And the voice of the Ph.D., like the turtle's, is now heard in our land.

Anthropology, it must be admitted, owes some of its growth to this general expansion of the graduate field, but not all of it by any means. As one of the social sciences, it is also enjoying a share of the attention that a troubled world is directing toward these sciences. Faced with catastrophic dangers, sharpened by the technological advances of modern times, government, institutions, foundations, and thoughtful individuals are being forced to acknowledge that the role of the social sciences must be made a determinative one if our world is to survive. Unquestionably the pressure of events has thus created a more receptive attitude toward these fields of study and has disposed those who dispense research money and academic preferment to look more favorably on anthropological ventures than they did in the past.

Anthropology, however, has not been supinely carried on the crest of a wave of expanding graduate study. Nor, to change the figure, has it effortlessly ridden the coattails of the social sciences. Some of the credit for the present position is due to its own accomplishments and to the promise it holds for still greater achievements.

In retrospect, then, we see a combination of favorable circumstances conspiring in the past generation to advance the intellectual prestige and the academic status of anthropology. These are:

(1) The general demand for an increased standard of education, which has been a progressive one for a long time but which has recently taken on a marked acceleration and has carried unprecedented numbers to the graduate schools.

(2) The widespread concern of people over the state of the world, and their growing conviction that social sciences may solve the problems created by technological developments in physics and chemistry. One can, I think, also detect a rising segment of opinion that looks to a religious revival and a moral regeneration as the way to save mankind. Nevertheless, the characteristic faith of our age in science has sharpened interest in the social sciences and has turned support to this relatively neglected field. The last report of the Carnegie Foundation points out that currently 73% of the funds voted for this year went to the social sciences. It is also significant that these grants were overwhelmingly concerned with projects "designed to bridge the gap between the universities and the world of affairs." In his report for 1947, Raymond Fosdick, president of the Rockefeller Foundation, lists a greater contribution to the social sciences than to any other of the fields in which the Rockefeller Foundation is interested. This is the culmination of a trend in that foundation's giving and reflects Mr. Fosdick's repeatedly expressed concern for the necessary development of the social sciences in the world of today. The same conviction finds expression in Mr. Conant's reports on Harvard developments.

(3) The success of anthropology in establishing the concept of culture and a methodology for dealing with it; but more particularly the timeliness of this

concept and methodology in respect to developments in other social sciences. Establishment of the cultural concept has had important consequences. It has on the one hand furnished social scientists and philosophers with a corpus of knowledge of great significance to them, thereby consolidating the value of anthropological investigation. And on the other hand anthropology has been encouraged by the nature of its problems to assume both a synthesizing role, in which various other sciences are drawn upon for methods and insights, and a cross-disciplinary function, in exploring the ramifications of the cultural concepts it elaborates. An example of its cross-disciplinary function is the wide interest in personality and culture which has grown out of the more and more refined study of cultural dynamics and which requires for its pursuit the collaboration of the various psychological sciences. Such a collaboration would have been impossible 30 years ago.

Armed with methods and insights derived from a century of investigation among primitive people, anthropology has only in this generation acquired the confidence to project itself into the complexities of modern civilizations. How much of this development was the inevitable evolution of our science it is difficult to say. There are some who still regret this trend and insist that classical ethnology should be confined to the study of primitive peoples and should remain our primary interest. I recall among my contemporaries in my own student days, however, an impatience with the conventional problems that seemed remote from the realities of our world and an eagerness to try our anthropological teeth on the richer fare of our own society. Perhaps this was a reflection of a *zeitgeist,* or the effect of inspired teaching or a response to the stimuli in the productions of cognate subjects. It would be interesting to know how far this eagerness was especially characteristic of American anthropology. In any event, it has led anthropology in this country to the very centers of our social conflicts and to the sources of national as well as individual behavior. Since we have insisted on having our say in these matters and on offering suggestions toward the solution of social problems, we must inevitably expect to shoulder the open responsibility that goes with this office. For whether we like it or not, we cannot escape the consequences of the role we are adopting. As professors of a science outgrowing its short pants (perhaps prematurely, as is the present fashion for boys) we have, I believe, a duty to assume a maturity consistent with anthropology's development. The days when we might act as if our theories were of little consequence to others are gone. For even if we retreat to the refuge of a pure science concerned only with abstractions and general principles, we should have learned from our recent past that some responsibility is inherent in our activities. I do not mean to imply that we either claim infallibility or that the public accords anthropological dicta an unprecedented prestige. We are still received with varying degrees of hospitality but more than ever we are listened to and what we enunciate as anthropological truth is carried far and wide.

Those of us who have seen this change in the fortunes of anthropology are also those whose recollections go back to the Wall Street bubble and the Florida boom, and we might be pardoned in the light of that experience for being at least mildly troubled about anything that looks like a boom. In our lexicon bust follows boom, and burst comes after bubble. I do not, however, speak as a prophet of gloom, for I happen to think that anthropology's future is bright if—and that "if" is what concerns me now.

As I have tried to point out, anthropology has at last arrived at a position where perhaps for the first time, at least in this country, its voice carries some weight both in academic circles and with the public at large. Its prestige within academic circles, of course, is of the utmost importance in providing careers, in the training of personnel and in the institutional sponsorship without which anthropological work might virtually cease. The concrete professional consequence may be seen in the rapidly growing number of anthropological departments in American universities—from a handful a generation ago to 90 recognized departments, by Erminie Voegelin's count, and to between 200 and 300 where anthropology is represented in curricular offerings. To maintain this development and to expand it further, anthropology must retain the confidence of its academic colleagues in the soundness of its research goals and methods.

Its standing with the public at large is equally necessary in preserving its academic status and particularly in attracting the intellectual and financial support that we require in our system. But more than this, our authority in the mind of the public carries with it a social responsibility. If what we give out as anthropological dogma is received as tested truth and eventually influences public attitudes, we cannot divest ourselves of the responsibility of our pronouncements. *Caveat emptor* is not a good rule in science. If by our disregard for this fundamental charge we encourage the public to beware of our offerings, we shall soon lack both a public and a science.

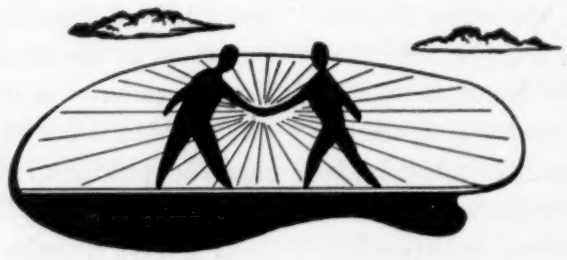
If I have overdrawn the picture, it is, nevertheless, valid. Far too often the anthropologist fails to make explicit to the people what may be sufficiently clear to the profession, namely that some of his generaliza-

tions are far from being the final blueprint they appear to be. It may or may not make much difference in dealing with fossil man, but there can be little doubt that it makes a vast difference when current social attitudes are involved. This, of course, is a problem in the public relations of all the social sciences and most, if not all of them have been guilty of this failure to distinguish the varying degrees of certainty or probability that characterize the theoretical structures they release to the public. No doubt competitive struggle for attention for one's ideas may motivate the form in which they are presented, and unquestionably many of us in our zeal may speak with honest if unwarranted conviction; but this does not excuse anthropology or anthropologists from the consequences of what we permit to stand as anthropological gospel.

I am not, by this statement of the position of the social sciences in general and of anthropology in particular, implying that what is needed is a board of censorship to protect the fame of these sciences from their own protagonists. Nothing could be more disastrous. Fortunately there is a simpler and healthier mechanism for achieving the kind of clarification for which I am appealing. This is in the development of a rigorously critical attitude toward the speculations and developments embodied in anthropological writing. This is all the more essential since anthropology, as well as the other social sciences, lacks the experimental procedures that exert a profoundly salutary control on the growth of the experimental sciences. Among them, a claim can be immediately checked under similar controls in hundreds of laboratories. And every serious claim is indeed subjected to the rigors of such justification before it becomes acceptable as part of the tested corpus of the discipline. On the contrary, our investigations do not lend themselves readily to this kind of testing. In fact, even repeat studies in the anthropological literature are quite exceptional. It is for this reason that I regard it as essential for the continued health of anthropology that we be severely critical in appraising the theories and investigations that are issued as representative of anthropology and which come within our competence. There is, of course, no lack of critical rigor in assessing work that falls into conventional patterns, for which standards and well-tried precedents of reliability are available. And certainly the older theories have with time been subjected eventually to a variety of critical appraisals. But one also notices an amazing failure to examine the fundamental assumptions and premises of new lines of investigation which, like a new fashion in women's wear, appear to exercise a kind of tyranny that no one dares question.

I do suggest that such critiques are desirable and I do know that a number of anthropologists do not hesitate privately or in their classrooms to offer critical comments—yet they are strangely silent in print. If we maintain such a silence, others can only assume that these developments are without blemish and unequivocally represent the best that we can produce. For a long time American anthropologists used to be accused of lacking a facility in theory and of being excessively conservative. I think that charge must certainly be withdrawn now. And I for one am glad to see the new interest in exploring possibilities of the anthropological approach. But anthropology can become healthy and remain so only in the presence of a strongly skeptical and critical spirit which, to be satisfied, requires the best.

[*Presidential Address, delivered at the 47th Annual Meeting of The American Anthropological Association in Toronto, December, 1948.*]



The Use of Autoradiographs in the Quantitative Determination of Radiation Dosages from Ca^{45} in Bone[1]

Robert A. Dudley and Brown M. Dobyns[2]

Laboratory for Nuclear Science and Engineering of the Massachusetts Institute of Technology and *Surgical Research Laboratories of the Harvard Medical School at the Massachusetts General Hospital*

BEFORE IT IS SAFE to introduce radioactive tracers into the human body, it is essential to know that the concentration will at no point become great enough to be a health hazard. The present safe dosage rate limit accepted by the Atomic Energy Commission is 0.1 rem (roentgen equivalent man) per day, or 0.1 rep (roentgen equivalent physical) per day for β-rays (quoted in *Nucleonics*, 1947, 1, 4). The problem of determining local radiation dosages rates is therefore of vital importance in the use of many isotopes. Conventional counter measurements of activity are practically useless in this application, because they give information regarding average dosage rates over a large area, a value which can be several times smaller than the local dosage rates. Therefore, an autoradiographic technique capable of quantitatively measuring local dosage rates in tissue has been developed and is described below. It is currently being applied to the study of radioactive Ca^{45} dosages in bone.

The method consists of making an autoradiograph of the tissue being studied, producing on the same film calibration exposures from radioactive sources of known activity, developing the tissue and calibration exposures simultaneously, and comparing their blackening microphotometrically.

The technique is similar to that described by Axelrod and Hamilton (*1*) for the radioactive sulfur and arsenic studies of mustard gas and lewisite concentration in the skin and eye tissues. However, local radiation dosage is capable of being measured more simply than local isotope concentration.

Concentration deals with the distribution of the radioactive atoms; dosage deals with the distribution of the ionizing radiation from those atoms. Since in concentration studies the atoms are detected by means of their radiations, precautions must be taken to detect each β-ray or photon near its origin; i.e., the tissue section must be thin (microtome-sliced) and the distance between the film and tissue must be minimal. Because of self-absorption and backscattering effects (*5*) it is difficult to compare in a quantitative manner the intensity of radiation from a thick source with that from a thin source. Therefore in concentration studies the calibration source should be of the same thickness as the tissue section—a requirement not always easy to meet in the laboratory.

Dosage measurements, with which this paper is concerned, require tissue sections of dimensions greater than the maximum range of the radiation particles in order that all the radioactive atoms within the range contribute their share of dosage (and therefore film blackening) at the point in question. To be precisely correct, the tissue section should also be large as compared with the mean free path of any accompanying γ-rays, but for practical purposes this would generally be unnecessary. If the volumes of localization are small, and if local concentrations are high (compared with average concentration), the high specific ionization particles produce almost all of the localized dosage, the low specific ionization γ-rays almost none. Since the dosage rate within an infinite, homogeneous source can be readily calculated by the formula given below, such a calibration source, easily prepared, is desirable in dosage studies.[3] The penetration of the radiation is partly dependent on the atomic number of the surrounding elements; therefore it is important that the calibration source be composed of material whose atomic number distribution is the same as that of the tissue. It is obvious that the isotope in the tissue and in the calibration source should be the same.

The dosage *within* this infinitely thick source can be calculated by the formula (*3*):

[1] Assisted by the joint program of the Office of Naval Research and the Atomic Energy Commission, by a grant-in-aid from the National Institutes of Health, and by a grant from Ciba Pharmaceutical, Inc. One of the authors (R.A.D.) has carried on part of this investigation under a National Cancer Institute Predoctorate Research Fellowship.

[2] The authors wish to thank Dr. Robley D. Evans of the Massachusetts Institute of Technology for his suggestions and guidance in this study.

[3] Certain errors result from the fact that film blackening is not a function of reps of irradiation alone.

$$R = 60\ CE$$

where R = reps/day
C = μc/gm tissue
E = average energy of particles (approximately one-third their maximum energy) in Mev.

This dosage rate (R) within a thick source is our primary consideration. It is approximately twice the dosage rate at the surface, for when a block of material containing a radioactive substance is cut in half, the intensity of the radiation at a point on the cut surface is only one-half the intensity of radiation at this same point before the cut was made. This principle applies to the interpretation of autoradiographs made from tissue as well as calibration sources.

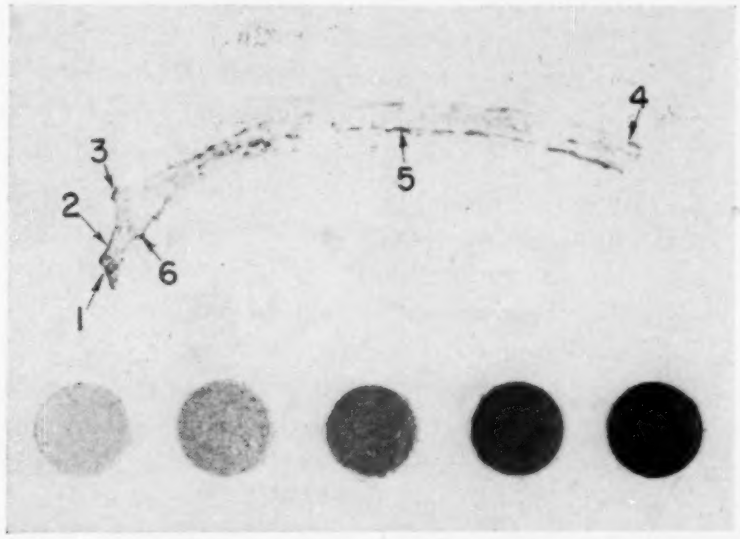


FIG. 1. Autoradiograph of dog rib resected 21 days after oral administration of radioactive Ca^{45}. The circles of graded blackening are calibration exposures increasing in magnitude by factors of 2, produced from plaster of Paris blocks containing known amounts of Ca^{45}.

The film characteristic most essential for accuracy is the contrast. Resolution is not of prime importance, since the scattering of the radiation in the thick source affects the film over a diameter comparable with the maximum particle range. Eastman No-Screen X-Ray Film was found to be a relatively good film to register the 0.26-Mev β-rays of Ca^{45} because of its high contrast and sensitivity. However, its resolution is rather low for the purpose, even though high resolution is not essential. It is also desirable to choose a film on which a given number of reps produce the same degree of blackening, regardless of the energy of the β-rays concerned. For energies less than 40 to 60 kev this requirement is not satisfactorily met by films now obtainable (*2*). This consideration is now being further investigated.

After the preparation of the tissue and calibration source, the procedure has been to make the autoradiograph and a set of five calibration exposures (each greater than the preceding by a factor of two) covering the range of exposures in which the film contrast is highest.[4] The blackening of the tissue autoradiograph is then microphotometrically compared with the blackening of the calibration spots, and the local radiation dosage rates in the tissue are thereby determined.

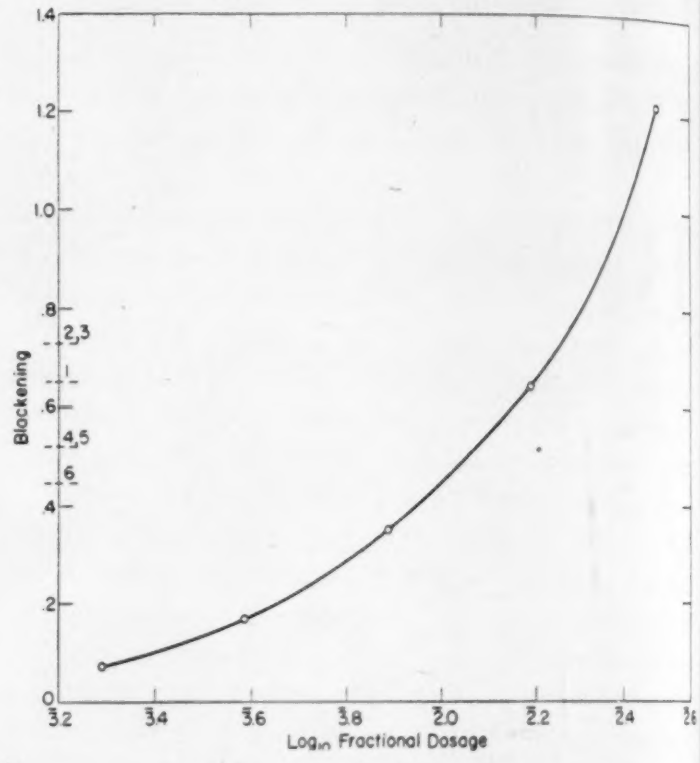


FIG. 2. Microphotometer record of calibration exposures and autoradiograph sites shown in Fig. 1. The points defining the curve are taken from the calibration exposures, and the dashed lines on the vertical scale indicate the blackening of the correspondingly numbered bone sites in Fig. 1. The activity of the calibration sources has been related to that of the dog's blood in such a way that the abscissa, essentially representing log (exposure), can be expressed in terms of log (fractional dosage).

An example of the work currently being done is shown in Figs. 1 and 2.[5] The study was made to determine the amount of dilution of radioactive Ca^{45} by normal calcium while passing from the blood to the bones of a growing dog. Fig. 1 shows the autoradiograph of a rib resected 21 days after the oral administration of the radioactive calcium, and five calibration exposures from artificial sources containing a known percentage of the peak blood activity. Fig. 2 shows the microphotometer record of the

(*Continued on page 342.*)

[4] Contrast is defined as the slope of blackening (also called density) vs. the log of the exposure. Blackening is defined as $\log \frac{I_0}{I}$, where I_0 and I are the intensity of the light transmitted through the clear film and the spot in question, respectively. Since to a good approximation, the microphotometer deflection $M \propto I$, the contrast is, closely, the slope of $\log \frac{M_0}{M}$ vs. log exposure.

[5] Complete biological results will be published later.

TECHNICAL PAPERS

Absorption of Radioactive Calcium by the Peanut Fruit[1]

Roger W. Bledsoe, C. L. Comar, and H. C. Harris

Florida Agricultural Experiment Station, Gainesville

Nutritional studies of the peanut plant, *Arachis hypogaea* L., indicate the necessity of an external supply of available calcium in the fruiting zone for normal fructification (*2, 3, 6*). The relation of the calcium supply to fruit development is the type of problem particularly suited to radioactive tracer study. The availability of calcium 45 facilitates the investigation of this fundamentally and economically important problem.

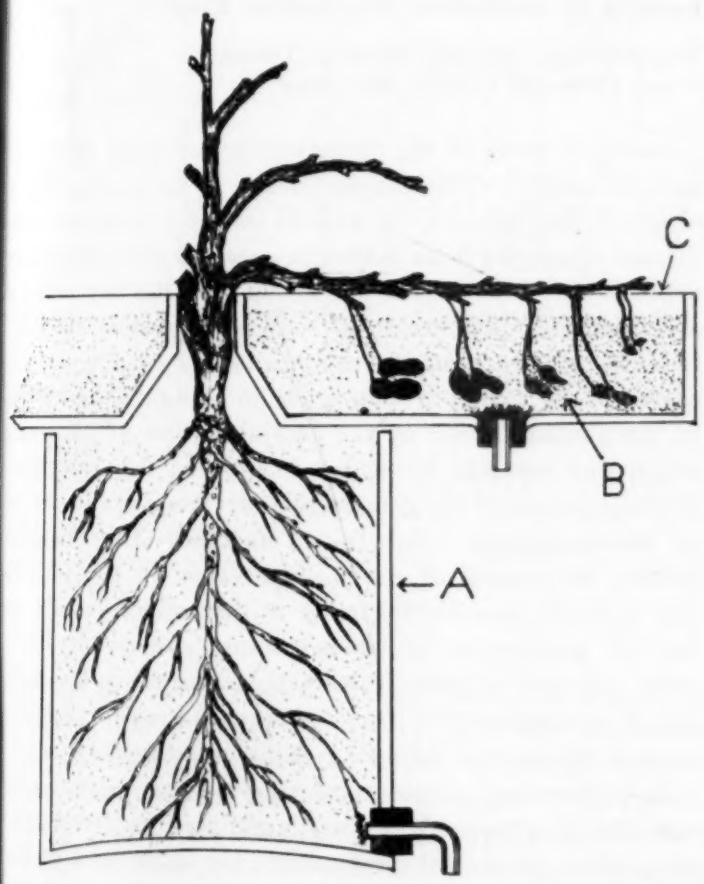


FIG. 1. Diagrammatic view of the peanut plant showing: A, rooting medium; B, fruiting medium; and C, wire mesh support to prevent branches and foliage from touching sand of the fruiting medium.

The runner-type peanut has a prostrate growth habit and bears its fruit from nodes along the trailing branches. Thus it is possible to separate completely the rooting medium from the fruiting medium of the plant. Peanut plants of the Dixie Runner variety were grown in sand culture with the root and fruit zones isolated from each other as shown in Fig. 1. The roots of 2 plants were in 4-gal glazed crocks and the sand of the fruiting zone was held in asphaltum-coated metal pans. A complete nutrient solution (*1*) was applied to the surface of both zones of the plants. When necessary, solution drainage from each zone of the plants was caught in 5-gal carboys. At 110 days plants were vegetatively vigorous and all stages of immature fruit development were present. At that time a single application of labeled calcium, as a solution of the chloride containing approximately 1.36 mg of calcium with an activity of 21 mc, was added to 1 l of nutrient solution and applied to the rooting or fruiting medium of each culture of 2 plants. Thereafter, drainage of any solution was returned to the proper receptacle. The fruiting zone treatment was discontinued after 9 days but the treatment of

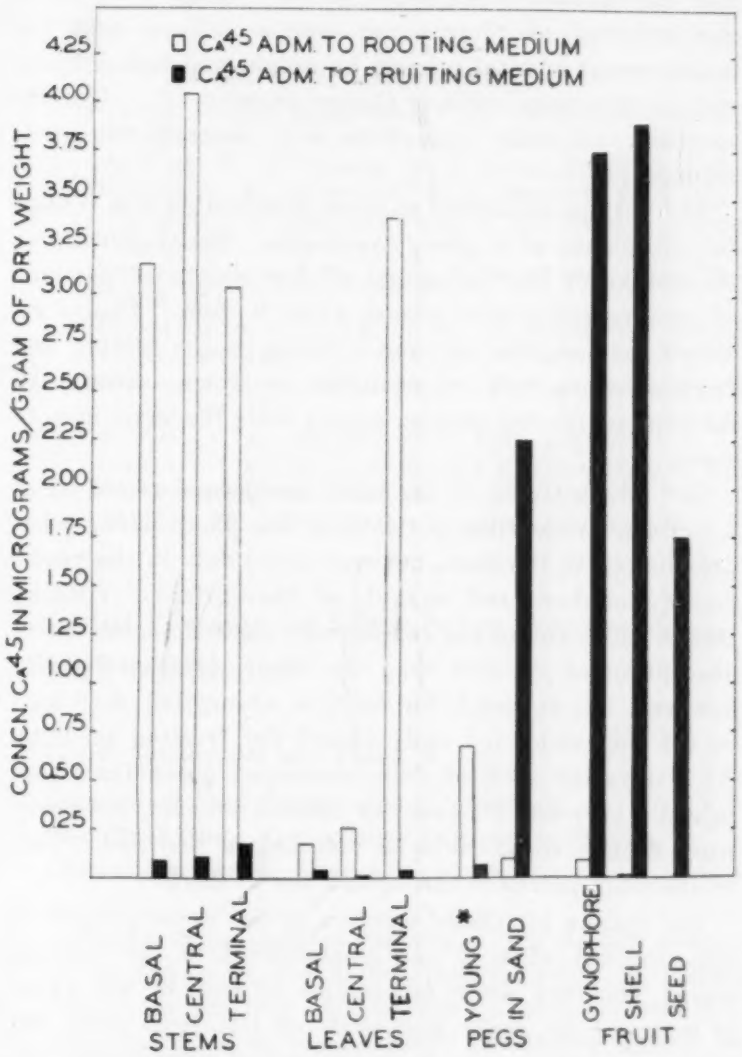


FIG. 2. Concentration of Ca^{45} in various portions of peanut plants 9 days after it was administered to the rooting or fruiting medium. The asterisk indicates young pegs (1" – 1½" long) which had not touched sand of fruiting medium.

[1] Published with the permission of the director of the Florida Agricultural Experiment Station. The Ca^{45} was obtained from the Oak Ridge National Laboratory on allocation from the U. S. Atomic Energy Commission.

the root cultures was continued for 24 days. There were 4 replicates or a total of 8 plants to each treatment, and each plant, whether treated on the rooting or fruiting zone, was exposed to the same dosage of labeled calcium.

Leaves and sections of stems and fruiting organs of plants were sampled at periods of 3, 8, and 50 hr, and 9 and 24 days. Samples of leaves and stems were from lateral branches, since the peanut plant has a short upright central stem. Gynophores and fruits were thoroughly washed with a stream of distilled water when harvested. Samples were immediately weighed and subsequently dried at 70° C. The plant material was ashed and the calcium precipitated as the oxalate (*7*), which was collected on filter paper over a uniform area for measurement of total calcium by weight and radioactivity with a thin mica window Geiger counter (*5*). Self-absorption and decay corrections were made in the usual manner (*4*).

The pattern of labeled calcium distribution was similar for all plants of a given treatment. Fig. 2 illustrates the uptake of Ca^{45} in μg/gm of dry weight of portions of two representative plants after 9 days. Plants received the complete nutrient solution on the rooting and fruiting zones, and experimental conditions other than the zone of labeled calcium supply were the same in both cases.

Ca^{45} administered to the roots could be detected after 3 hr in all vegetative portions of the plant, being most pronounced in the stem, but was found only in the young peg (gynophore and ovary) of the different fruiting stages. The young peg consistently showed a more active absorption of calcium than the other classes of fruit; however, the capacity for calcium absorption decreased as the peg elongated and entered the fruiting medium. At 9 days the shell of fully developed green fruit contained a very small amount of labeled calcium, but never more than a trace could be detected in the seed. This relationship persisted throughout the 24 days.

The uptake of labeled calcium by the developing fruit was reversed when it was administered to the fruiting zone. The very active absorption of Ca^{45} by the gynophores and by shells and seeds of the fruit from the external supply in the fruiting medium very greatly exceeded the small amount of absorption by these organs when labeled Ca was supplied to the rooting zone of the plant. This emphasized the capacity for calcium absorption by the developing fruit from the external supply in the fruiting medium.

It is noteworthy that when labeled calcium was applied to the roots of the plant, the capacity for calcium absorption by the young peg decreased as it developed as shown by the decreased absorption of labeled calcium. Thus it appears that the calcium content of the young peg was diluted as it increased in size and that most of the Ca^{45} found in the fruit was absorbed in the early stages of peg development. This suggests that the capacity for calcium absorption by the gynophore and ovary is limited after a definite point during their development and that further fruit development is apparently dependent upon the external supply of calcium in the fruiting zone.

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The Influence of Delta and Gamma Benzene Hexachloride upon the Oxygen Uptake of Brain[1]

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During a study of the pharmacology of some stereoisomers of benzene hexachloride (BHC) in mammals, it was observed that whereas the gamma isomer is a potent convulsant agent, the delta isomer is a central nervous system depressant. Moreover, it was found that the two isomers are mutually antagonistic in their effects upon the central nervous system of the rabbit and dog (*5, 6*). In the same studies attempts were made to mitigate the effects of the gamma isomer by the administration of *i*-inositol which was reported by others to prevent the growth-inhibiting action of the gamma isomer upon certain strains of saccharomyces (*4*). In no instance did *i*-inositol modify the course of convulsant action of γ-BHC. It was believed possible that this failure might be due to lack of penetration of *i*-inositol into susceptible brain cells. In view of these observations, and the often mentioned correlation (*1–3, 7–9*) between narcosis and brain oxygen uptake, the following study was initiated.

In exploratory studies rats received intraperitoneally sufficient drug to produce central stimulation (100 mg/kg of γ-BHC) or central depression (500 mgm/kgm of the delta isomer). The rats were decapitated after the onset of symptoms, and the QO_2 of brain slices was determined manometrically. By this method no difference could be observed between control and test brain slices. For the experiments reported herein, the following technique was employed: Normal rats were killed by decapitation, and the brains were removed and weighed. The entire brain

[1] In previous reports the authors used the word "Gammexane" as a synonym for the gamma isomer of benzene hexachloride. It has been brought to our attention that the name "Gammexane" is a trade mark designation of the Imperial Chemical Industries, Ltd. The term gamma benzene hexachloride has been approved by the Committee on Insecticide Nomenclature of the American Association of Economic Entomologists (*J. econ. Entomol.*, 1947, **40**, 280).

[2] The technical assistance of Anne M. Kunkel and Dorothy E. Stabile is gratefully acknowledged.

was then placed in a homogenizer tube and 0.05 cc of a 10% solution of the drug in peanut oil per gram of brain was added. Pure oil was added to controls. The brain and the oil solutions were then homogenized. Sufficient quantity of a modified Krebs phosphate solution (containing 0.1% glucose) was added to make the final homogenate, containing 125 mg brain (wet weight) in 3 cc. This technique was necessitated by the low water solubility of the BHC isomers. The homogenate was equilibrated with room air at 38° C for 10 min and allowed an additional equilibration period of 10 min after the vessels were closed. Readings were taken at 15-min intervals for a period of 1 hr.

TABLE 1

EFFECT OF ISOMERS OF BENZENE HEXACHLORIDE ON BRAIN OXYGEN UPTAKE

Compound	Brain (mg/gm)	No. of determinations	QO_2 (wet wt)	Ratio experimental/control
Control	....	9	0.79 ± 0.1*	1.00
Alpha	2.5	6	0.92 ± 0.07	1.16
	5.0	6	0.97 ± 0.07	1.23
Gamma	5.0	11	0.76 ± 0.06	0.96
Delta	0.5	4	0.93 ± 0.10	1.18
	1.25	5	1.13 ± 0.09	1.43
	2.5	5	1.23 ± 0.13	1.56
	3.75	5	1.46 ± 0.07	1.85
	5.0	11	1.40 ± 0.16	1.77
Delta	5.0	4	1.41 ± 0.19	1.78
+				
Gamma	5.0			
Delta	5.0	1	1.35	1.71
+				
Inositol	25.0			
Gamma	5.0	1	0.77	0.97
+				
Inositol	25.0			

* $\sqrt{\frac{Ed^2}{N}}$

The QO_2 values obtained on rat brain homogenates containing added drugs are shown in Table 1. Whereas γ-BHC failed to alter the oxygen uptake of the brain, the delta isomer significantly increased this function. Inositol did not alter the oxygen uptake produced by either isomer and γ-BHC exhibited no antagonism against the effects of the delta isomer.

The most striking fact obtained from this study was the unexpected position of the two isomers with respect to their effects upon the brain-homogenate respiration. The narcotic isomer (delta) produced as high as an 80% increase in respiration over the control. Moreover, its pharmacological antagonist, the gamma isomer, a powerful convulsant, did not modify this effect. In addition, i-inositol was similarly without effect. The "stimulating effect" of the delta isomer upon the respiration of brain homogenate in the face of its narcotic properties *in vivo* is not yet understood and requires further study. The possibility that this increased oxygen consumption is merely a reflection of the oxidation of the halogenated hydrocarbon cannot be overlooked. However, it is interesting to consider these facts in light of the previously mentioned hypothesis of the mechanism of action of certain narcotic agents.

The unaltered QO_2 values observed in the exploratory studies on rats poisoned prior to decapitation is also noteworthy. Similar results have often been observed for other anesthetics which depress the oxygen uptake of the brain on direct addition *in vitro*. Quastel (7) explains this by an outward diffusion of the drug from the cells to the medium. It does not seem likely that this explanation would hold in the case of the isomers of BHC since these compounds are oil rather than water soluble. No explanation for this divergence can be offered at this time.

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Color Change of Strawberry Anthocyanin with D-Glucose[1]

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Strawberries (garden varieties) are usually prepared by mixing with granulated sucrose prior to freezing. Due to the scarcity of this sugar during the war years, experiments to substitute other sweetening agents were initiated. When crystalline glucose was used a violet-to-blue coloration developed on freezing, which reverted to the original red color on thawing. This color change with glucose may be peculiar to strawberries, since it has not been observed with small fruits such as red raspberries. Interest in the applied as well as in the fundamental aspects of this phenomenon led us to an investigation.

Customarily, sliced strawberries are frozen with sucrose in a ratio of four parts of fruit to one part of sugar. In this preparation no change in color occurs. However, thirty varieties of strawberries grown in Geneva all turned violet when frozen with ordinary commercial crystalline glucose at −23.3° C. in a four to one

[1] Approved by the Director of the New York State Agricultural Experiment Station October 18, 1948 for publication as Journal Paper No. 778.

ratio. Differences in the time required to produce the color change were observed. Ten samples of the same variety (Dresden) showed color variations of essentially the same order of magnitude as those obtained with the different varieties. The only exception was a recently named strawberry, Fairland, which showed violet color only after 27 days' storage. Common varieties like Marshall, Blakemore, Dresden, Howard 17 and Culver all turned violet in one to five days. The minimum amount of glucose required to produce the violet color in the strawberries was found to depend largely on the presence of undissolved glucose. Violet color formation was observed only in those samples which contained glucose in a solid form. It is significant to note that all the violet material was always found associated with the undissolved glucose and that in those places where there was no solid glucose the strawberry preparation stayed red. Whether the glucose crystallized during storage or whether it was originally present as a solid did not seem to affect the color change. Another observation was that the time of separation of the glucose often does not coincide with the first appearance of the violet color.

As was expected, the anthocyanin pigment of strawberries plays a dominant role in the violet color development. When the anthocyanin chloride (*1*) (believed to be mainly pelargonidin 3-monoglucoside) is dissolved in Sorensen's sodium citrate-hydrochloric acid buffer of pH 3.4, or distilled water, and the solution is saturated with chemically pure D-glucose, and frozen at − 23.3° C, a violet color is obtained. If similar solutions are allowed to evaporate at room temperature, the anthocyanin also turns violet. This residue is stable at room temperatures. The anthocyanin reverts to the red form when the frozen samples are thawed or when distilled water is added to the dry material.

These tests led to the conclusions that (1) the violet color is not due to possible impurities of the glucose used since c.p. D-glucose gives identical results; (2) low temperatures are not necessary for the formation of the violet color; and (3) the color change is reversible. The rate of color formation is influenced by the pigment concentration. Solutions containing 25% glucose showed violet spots after 10 days' storage at − 23.3° C only if the anthocyanin concentration was 12 mg% or higher. The role of pH seems to be of minor importance. When the pH of frozen samples is lowered to pH 3.0, 2.5 and 1.8 a retarding affect with increasing acidity is noted. The air-dried, violet anthocyanin-glucose mixture turns red on heating. The transition temperature, which is not very sharp, is between 65° and 70° C for the pulverized material. Whether or not a loss of water occurred during the heating period was not determined.

Although a number of sugars were tested, only glucose gave a characteristic color change with the anthocyanin. Tests with sucrose, galactose, rhamnose, fructose, maltose, and α methyl glucoside were negative. Several of these sugars did not separate from solution under the conditions of the experiment and this may have caused the negative results. Inconclusive results were obtained with invert sugar. Arabinose seems to have a very slight effect.

Should it be found that the described reaction really is specific for pelargonidin 3-monoglucoside (or other glycosides of pelargonidin) it could well serve as a qualitative test for these compounds.

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The Effect of Pteroylglutamic Acid on the Aromatic Amino Acid Metabolism of Premature Infants[1]

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Scorbutic guinea pigs fed tyrosine (*4*) and prematurely born infants fed cow's milk mixtures of relatively high protein content (*3*) excrete large amounts of hydroxyphenyl derivatives in the urine. These can be decreased markedly by the administration of ascorbic acid (*3, 4*). Woodruff and Darby (*5*) studied the effect of administration of PGA on the excretion of hydroxyphenyl derivatives by scorbutic guinea pigs and found that PGA repaired the defect produced by lack of ascorbic acid. Johnson and Dana (*2*) have reported that ascorbic acid produced significant increases in weight gain and leucocyte and normoblast count in PGA-deficient rats.

TABLE 1

EFFECT OF ORAL PGA ON "TYROSYL" EXCRETION

Infant B. L.—weight at birth: 2.15 kg

Age in days	Weight in kg	Urine "tyrosyl"	
		mg/cc	mg/kg/24 hr
14	2.04	1.5	40
16	2.05	1.1	34
21	2.47	.4	18
29	3.98	5.2	289
30	2.95	5.4	357
31	PGA—5 mg started daily by gavage		
34	2.95	4.8	368
37	3.09	4.3	279
41	3.10	3.4	234
42	PGA—10 mg started daily by gavage		
44	3.26	3.1	267
46	3.40	1.4	112
50	3.52	0.2	17

In the present study, PGA was given to 10 premature infants fed cow's milk mixtures containing 6 g of protein and 120 cal per kg of body weight per day, but no ascorbic acid. Urine was collected for timed periods

[1] Aided by grants from the Mead Johnson Company, Evansville, Indiana, and Continuing Research Fund of the University of Colorado Medical Center.

[2] Postdoctoral Fellow of the United States Public Health Service.

of approximately 24 hr and hydroxyphenyl derivatives were determined (*1*).

All ten infants excreted significant amounts of "tyrosyl" before administration of PGA. For one infant, A.L., the gavage feeding of 5 mg of PGA daily for seven days produced a striking decrease in "tyrosyl" excretion, which persisted as long as 13 days following cessation of PGA therapy. For his twin brother, B.L., gavage administration of 5 mg daily for 10 days was without effect, but 10 mg was effective after four days, (see Table 1). For infant P., the gavage feeding of 30 mg of PGA for eight days was ineffective, but the intramuscular injection of the same dose for two days led to a prompt drop in hydroxyphenyl excretion (see Table 2). For infant R., the administration of folic acid, 10 mg orally for 16 days, had a partial effect, but the administration of 30 mg intramuscularly for three days produced a striking effect. For the remaining six infants, PGA was ineffective whether given orally or by gavage in daily doses of 10–30 mg for periods of 8–15 days, or intramuscularly in daily doses of 15–30 mg for periods of 5–8 days. In five of the six infants for whom PGA was ineffective and who were given ascorbic acid, there was a prompt decrease in excretion of hydroxyphenyl derivatives. The findings for one infant in this group are given in Table 3.

TABLE 2

EFFECT OF INTRAMUSCULAR PGA ON "TYROSOL" EXCRETION

Infant P—weight at birth: 0.97 kg

Age in days	Weight in kg	Urine "tyrosyl"	
		mg/cc	mg/kg/24 hr
48	2.01	3.4	224
52	2.24	3.2	187
53	PGA—30 mg started daily by gavage		
57	2.27	4.4	227
61	2.35	3.2	273
61	PGA discontinued		
65	2.50	4.8	281
69	2.55	5.1	286
74	2.78	4.1	310
76	PGA—30 mg started daily by intramuscular injection		
78	2.92	0.2	10.0

TABLE 3

LACK OF EFFECT OF PGA ON "TYROSOL" EXCRETION

Infant B. P.—weight at birth: 2.19 kg

Age in days	Weight in kg	Urine "tyrosyl"	
		mg/cc	mg/kg/24 hr
15	2.13	4.6	240
17	2.27	4.5	337
18	PGA—10 mg started daily by gavage		
20	2.30	3.0	291
23	2.50	4.4	290
27	2.64	4.8	324
31	2.75	5.1	380
32	PGA—20 mg started daily by gavage		
37	2.95	6.1	212
39	3.03	3.9	278
43	3.15	4.6	282
43	PGA—15 mg started daily intramuscularly		
48	3.32	4.4	242
48	PGA discontinued—ascorbic acid 100 mg intramuscularly		
52	3.43	0.4	33

Definition of the conditions under which pteroylglutamic acid is or is not effective in premature infants remains the subject for future studies. It is of interest that a difference dependent on the route of administration was the deciding factor in two of eight infants tested. The variability in response recalls a similar experience with liver extract noted in a previous study (*3*).

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A Method for Self-Control of Population Growth among Mammals Living in the Wild[1]

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It is a common observation that the numbers of most organisms in a reproducing population reach an equilibrium with the conditions of their environment. In approaching this upper limit of the logistic of the population, Pearl (*2*) has pointed out that "the rate of reproduction or fertility is negatively correlated with density of population." This is merely a statement of fact which prompts the study of the mode by which the reduction in contribution of progeny to the population occurs. Whatever the means of reduction, the result is that there are less adults to compete for the existing supply of food and harborage.

A recent note in *Science* by Mirone, *et al.* (*1*) suggests one possible way in which the increment to a population may be effectively reduced. They observed in mice that newborn young of mothers on a poor diet frequently fail to survive past the fourth day. From the fact that these same mothers may successfully rear adopted litters born to mothers on an adequate diet, they conclude that failure of the litters to survive is due to inadequate nutrition during gestation. This conclusion suggests that any environmental conditions which affect the maternal

[1] The work reported in this paper was conducted under a grant from the International Health Division of the Rockefeller Foundation.

physiology to the extent that foetal nutrition is lowered will slow down the rate of population growth due to early post-parturition mortality.

Recent observations on the growth of a colony of wild Norway rats (*Rattus norvegicus*) indicate that this process of upsetting maternal physiology may be one of the limiting factors in population growth. This experimental colony is maintained in a 100′-square pen where abundant food (Purina fox checkers) is continually available in a 20′-square central pen to which the rats gain access by four narrow passages. Fig. 1 shows details of the pen.

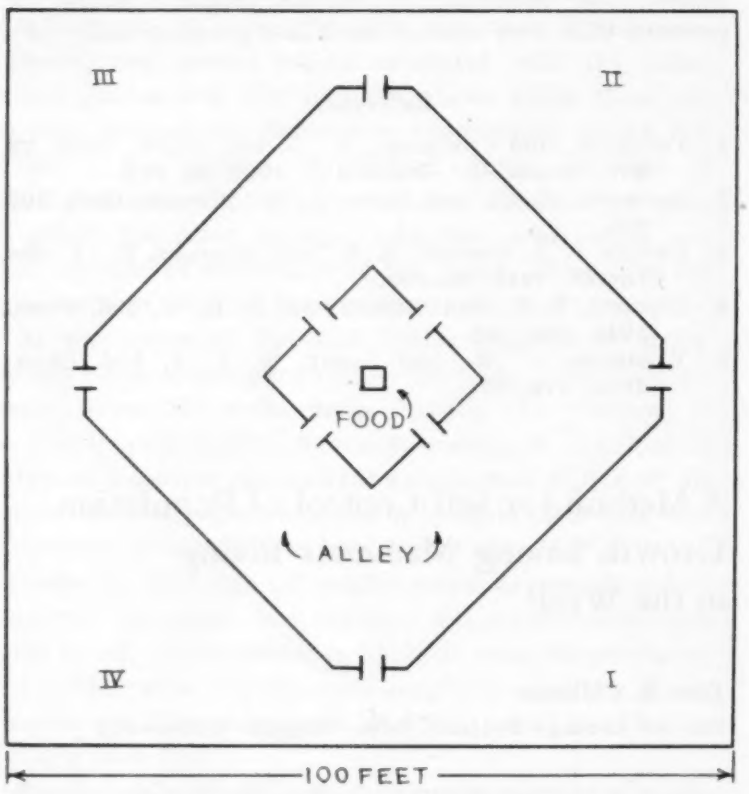

FIG. 1. Diagram of pen in which rats are housed: outer, central, and middle fences which prevent rats from passing over or under them; 8 passages through fences (3″ clay drain tiles); food and water continuously and abundantly available in central pen; 9 harborage boxes in each of the 4 triangular corner areas; rats allowed to dig burrows in alley and in triangular areas.

The colony in the pen was begun with five pairs of rats, which are assumed to have been as genetically homozygous as it is possible to trap them in the wild state. This assumption is made on the following inferential grounds. The rats were trapped in February 1947 on Parsons Island, a 150-acre tract of land in the Chesapeake Bay. Its land bridge with the mainland was severed about 40 years ago, since which time the rats have been effectively isolated. The number of rats on the island has fluctuated widely both on an annual basis and on the basis of changes in agricultural practices. An experimental reduction by poison in 1923 was conducted by the Fish and Wildlife Service. A second experimental reduction was conducted in the spring of 1946 by J. T. Emlen and D. E. Davis, of the Rodent Ecology Project. Estimations of numbers: (a) pre-poisoning, 670; (b) post-poisoning, 220. At the time of trapping in February 1947 surveys indicated that there were probably no more than 150 rats on the island. Under these circumstances of fluctuation in population size, it might be anticipated that considerable homozygosity would have been reached through gene drift (*3*). It is from this inference that the conditions here reported are judged to arise from environmental rather than hereditary differences.

Rats living in the triangular areas were further from the food source than were those living in the alley. There was thus produced a simple gradient of availability of food in which one group of rats had an advantage over another group. This gradient of availability of food was intensified by the social life of the rats. Rats become attached to certain areas of the pen and their movements are mainly confined to these areas and from it to the food pen and back. In order to get to the food pen, rats living in the triangular areas frequently must pass near the burrows of rats living in the alley. At such times they may be repulsed by the resident rats. Such repulsion is particularly severe when the resident alley rat is a lactating female. With frequent repulsions the individual's growth rate is slowed down, and since weight is a major factor in winning combats, such individuals occupy a low position in the social hierarchy, and in extreme cases the individual becomes so inhibited that it approaches the food pen with great caution, even when no other rats are about.

TABLE 1

PHYSICAL STATE AND REPRODUCTIVE CONTRIBUTION*
(January 1 to September 25, 1948)

		Average wt. (gms)	Average wounds	No. of pregnancies	Litters weaned
Born in an Area Harborage Box	♀ 17	379^{7}	14^{6}	3	1?
	♀ 20	388^{4}	14^{4}	4†	0
	♀ 25	371^{7}	15^{9}	5†	0
	L – 3 ♀♀	379	14.3	12	1?
Born in Alley Burrow	♀ 33	451^{1}	1^{3}	3	2 (3rd?)
	♀ 37	411^{1}	0.6^{5}	5	4
	♀ 43	426^{5}	3^{1}	4	4
	L – 5 ♀♀	429	1.5	12	10

* Superscripts denote number of observations from which averages were determined.

† Each includes 2 pregnancies for the fall of 1947.

To illustrate the effect of social conditioning on physical well-being and reproduction the histories of three females from each of two litters are given in Table 1. Litter 3 (L-3) was born May 30, 1947, in one of the triangular areas. Litter 5 (L-5) was born August 16, 1947, in the alley near the food pen. Though born 2½ months later the L-5 females average 50 gms heavier than the L-3 females as adults. As individuals, the upper asymptote of their growth curves was reached in 8 months by L-5 females, but not until 12 months by L-3 females, when weight is used as the criterion. The degree

of social inhibition is reflected in the number of fresh wounds recorded at each time of handling. It is the loser in a combat which usually receives wounds as it turns to flee. L-3 females received nearly 10 times as many wounds as L-5 females.

It so happened that the total number of pregnancies for the females in each litter to the last date of handling was the same. The contrast between the two groups in their reproductive history lies in the fate of their litters. Although the socially dominant, larger females were known to have weaned 10 litters from their 12 pregnancies, the socially inhibited individuals with a retarded growth rate definitely weaned no more than one litter. These observations give no direct evidence as to the cause of the differential survival rate of the young of these two groups of females. However, the histories of the mothers indicate that there is a physiological and psychological disturbance in socially inhibited individuals which might have a deleterious effect on the progeny either through poor foetal nutrition or from breakdown of maternal instincts. At any rate, social conditioning may be a potent factor in population control among mammals.

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Chemical Analysis of Spectrophotometric Findings in the Cerebrospinal Fluid

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An attempt to interpret the absorption band shown by cerebrospinal fluids (CSF's) at 2,650 A has to take into consideration a number of substances (*4*): barbiturates, ascorbic acid, purine-pyrimidine compounds and also, to a certain extent, proteins, although the latter give a maximum absorption at a somewhat longer wavelength (2,750 A). While it is easy in most cases to exclude barbiturates by avoiding or stopping their administration several days before the spinal tap, it seems desirable to determine by chemical methods the relative participation of the other components responsible for the absorption at 2,650 A. In 40 CSF's of patients with organic or functional nervous disorders, the ultraviolet absorption and the ascorbic acid content were determined simultaneously, the first by means of a Beckman photoelectric spectrophotometer, the latter by the method of Robinson and Stotz (*2*), as recommended by Satterfield (*3*), and using a Klett-Summerson colorimeter. The data resulting from routine examination of the CSF (total protein, globulin, cell count, Wassermann, colloid gold) were available. In cases in which these data and/or a shift of the ultraviolet peak to 2,750 A indicated an increase of proteins, we determined the protein content also, after the spectrophotometric study; the opalescences caused by sulfosalicylic acid both in a known standard solution and in the CSF were compared by means of the Klett-Summerson colorimeter.

With the help of our standardization graphs, the ascorbic acid values were converted into extinction coefficients and these values (Ea) were subtracted from the experimentally determined extinction coefficients of the CSF (Ecsf) so that a difference (D_1), unaccounted for by the ascorbic acid, resulted. Similarly, the protein values were converted into extinction coefficients (Ep), so that finally a residual value (D_2 = Ecsf-Ea-Ep) was obtained.

The material was arbitrarily divided into three groups, one with low D_1 values (0–0.4), one with intermediate D_1 values (0.41–0.8), and one with high D_1 values (above 0.8). In the first group showing D_1 values below 0.4 and D_2 values up to 0.14, apparently the ascorbic acid and protein content of the CSF accounted for the selective absorption with the peak at 2,650 A. These were cases without definite structural alterations of the central nervous system or with preponderant lesion of the white matter, cases studied one or more years after cerebral injury or in the early stage of cerebral affection.

In group II, showing D_1 values between 0.45 and 0.8 and D_2 values up to 0.61, there were cases of herniated discs, cerebral dysrhythmias, head traumata, an encapsulated metastatic carcinoma of the brain, and a hydrocephalus.

In group III, with D_1 values varying between .84 and 2.3 and D_2 values up to 2.16, ruptured discs, producing spinal block, convulsive disorders, concussion studied shortly after the accident, post-traumatic encephalomalacia, compression of the spinal cord, and particularly tumors of the central nervous system were found. It should be emphasized that this enumeration is only descriptive, and that differential diagnostic conclusions will depend on further studies on a larger material.

These findings indicate that the selective absorption of CSF's cannot be explained in all instances by the ascorbic acid and protein content as claimed by some authors (*1, 7*). In interpreting the residual D_2 values, it seems of interest that they were particularly pronounced in tumors of the central nervous system, i.e., in conditions where a marked destruction of nuclear substances may be expected. It should also be noted that there was a statistically significant difference between the mean E of normal control CSF's and that of CSF's withdrawn between 1 hr and 2 months after cerebral concussion (*6*), and also that D_2 values above the normal range were demonstrable in CSF's tapped shortly after cerebral concussion. These observations are mentioned because this type of cerebral trauma induces chromatolytic changes in the nerve cells (Windle *et al.*, *8*). It therefore seems justified to assume that the residual D_2

values observed are caused chiefly by constituents of nuclear substances such as purine-pyrimidine compounds.[1] These are not necessarily nucleic acids, but may be their cleavage products, as pointed out previously (Spiegel-Adolf *et al.*, *5*).

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Some Effects of Nonherbicidal Concentrations of 2,4-D on the Development of the Bean Plant

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Reports on the influence of nonherbicidal concentrations of 2,4-D on bean plants have been published by Wittwer and Murneek (*8*), Weaver (*7*), Burton (*1*), and Stromme and Hamner (*6*). The results of the preliminary experiment reported here confirm and extend previous observations on the morphological effects of 2,4-D on beans and on the delaying and inhibiting effect of 2,4-D on reproductive development found by Weaver (*7*) and Stromme and Hamner (*6*). No hastening of maturity or increase in yield such as was reported by Wittwer and Murneek (*8*) was found in this study.

Plants of *Phascolus vulgaris* L. (var. bountiful) were sprayed on both surfaces of all leaves with 1, 5, and 10 ppm of the sodium salt of 2,4-D on February 27, 1948, when they were 21 days old and had two fully expanded compound leaves. Although there were only four replications per treatment because of space limitation, statistical analysis of the data secured indicated the differences reported here to be statistically significant except where otherwise noted. Daily observations of the development of each plant were made, and all abscised leaves were retained for inclusion in the final dry weight determinations. The plants were allowed to complete their life cycles. No pods were removed until they were dry and mature, but they were picked before dehiscence to avoid the loss of seeds. By April 30 all leaves had abscised and all seeds matured. Dry weights were then determined.

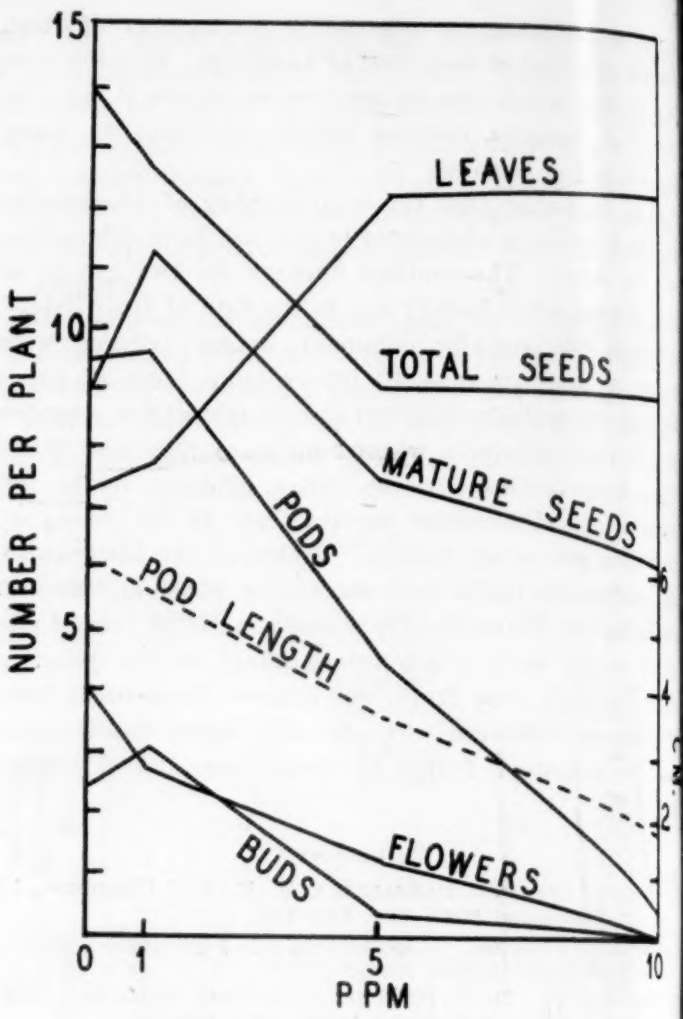

Fig. 1. Mean number of parts per plant and mean length of pods, illustrating the delaying and inhibiting effect of 2,4-D on reproductive development. The data on flowers and flower buds were secured March 10, on pods March 19, and on seeds and leaves April 30.

None of the treatments produced visible effects on the opposite, simple leaves, but the compound leaves of plants sprayed with 5 and 10 ppm exhibited characteristic inward rolling and epinasty. In three plants receiving 10 ppm the stem assumed a horizontal position, and the youngest fully expanded leaf a vertical position. The stem resumed vertical growth at the next node, but the horizontal portion remained in that position. Otherwise, recovery from epinasty had occurred by March 3. The 5- and 10-ppm concentrations caused a temporary inhibition of growth in height, but there were no significant differences in final height. By March 13 all plants sprayed with 5 and 10 ppm and, to a slight degree, some of those sprayed with 1 ppm had developed new leaves with crinkled, lanceolate, and mottled leaflets. The tissue adjacent to the veins became chlorotic, but the leaflet margins and vein islets remained green. By March 19 the leaves of the control plants and some of those on plants which had received 1 ppm were turning yellow, apparently due to the approach of maturity, but all leaves on the plants which received 5 or 10 ppm were still dark green. Small, white, conical outgrowths developed on the

[1] In this connection, it also seems noteworthy that in some conditions associated with a statistically significant increase of the selective absorption of the CSF at 2,650 A (e.g., following repeated electro-shock treatment), substances able to split *added* nucleic acids are increased in the CSF (*5*).

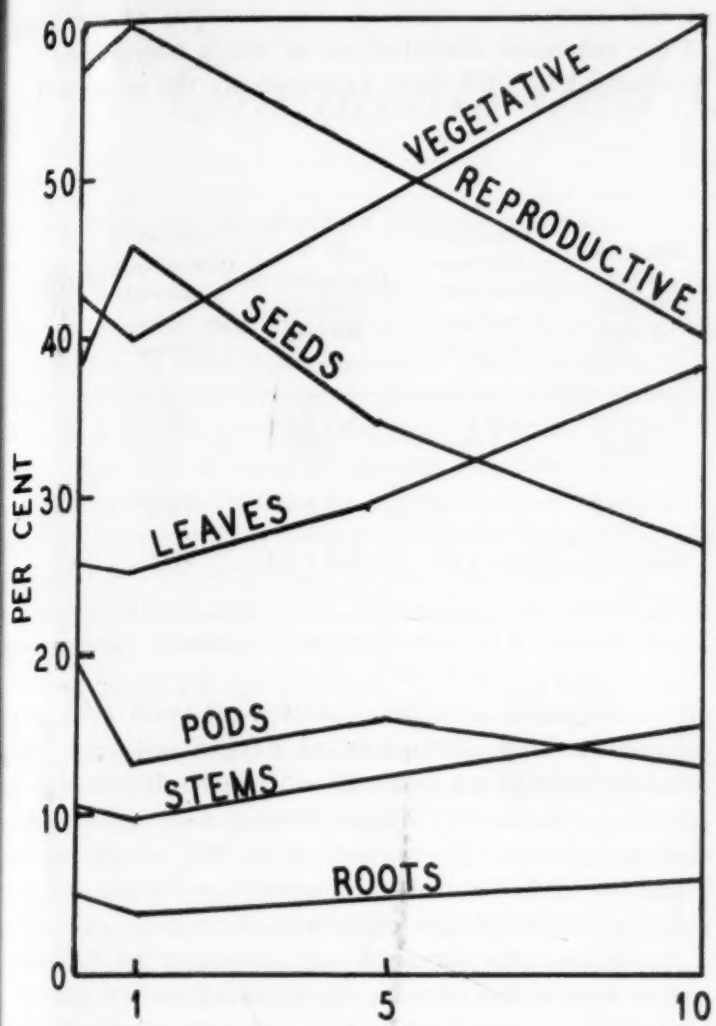

FIG. 2. Effect of 2,4-D on the dry weight of the various organs of bean plants and of the total vegetative and reproductive organs, expressed as percentage of the total dry weight.

under surfaces of some of the most deformed leaves. These were similar to those reported by Felber (*3*) but had developed during March and April, while Felber found such proliferations on the lower epidermis regularly only from June to October.

The 2,4-D appeared to promote, rather than to delay or inhibit, leaf abscission. Leaf abscission began on the controls and plants in all treatments on March 30 but was completed a weak earlier in the plants sprayed with 5 or 10 ppm than on the controls or plants sprayed with 1 ppm. The abscission of leaves from all plants reached a peak between April 11 and 14, and the rate during this peak period was higher for all treated plants than for the controls.

All controls and plants which received 1 ppm, and two plants which received 5 ppm began blooming on March 8, but none of the plants sprayed with 10 ppm bloomed until a week later. The number of macroscopic flower buds and flowers on March 10 is given in Fig. 1, and the data on pods in this figure provide additional evidence of the delaying effects of the 5 and 10 ppm concentrations on reproductive development. That this repression of reproductive development was not due to a general repression of growth is indicated by the increased vegetative development of the treated plants (Figs. 1 and 2). Some of the flowers on the plants sprayed with 10 ppm were deformed, having greatly reduced petals, elongated and exserted styles, and ruptured ovaries. The pods of the plants sprayed with 5 and 10 ppm were unusually dark green, and even those on plants sprayed with 1 ppm were darker green than the controls.

None of the treatments had a significant effect on total dry weight of the plants, but there were significant differences in the dry weights of the various organs (Fig. 2). The 5- and 10-ppm concentrations definitely produced a decrease in the dry weight of the reproductive organs and a concurrent increase in the dry weight of the vegetative organs. The 1-ppm concentration, however, produced a significant effect which was the reverse of this, due principally to the unusually high seed weight in this treatment. This was not due to a greater weight per seed, nor to a larger total number of seeds, but to a larger number of fully mature seeds (Fig. 1). In general, the weight per seed decreased with an increase in concentration. (The mean weight of the mature seeds of the controls was 0.328 gm, and mean weights of the seeds of the plants treated with 1, 5, and 10 ppm were 0.286, 0.337, and 0.259 gm, $\pm$ 0.020). There is no evident explanation for the high weight per seed in the 5-ppm treatment. The increase in the total dry weight of the leaves with concentration of 2,4-D was due to the increase in the number of leaves, rather than to an increase in weight per leaflet, which actually decreased with higher concentrations. It seems possible that the delaying and inhibiting effects of 2,4-D on reproductive development reported here and by other investigators are the same type of phenomenon as the inhibition or delay action of other growth substances, reported by Dostal and Hosek (*2*), Obsil (*5*), Galston (*4*), and others.

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The Effect of Castration and of Testosterone upon the Respiration of Rat Brain

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In an earlier paper (*3*) it was reported that various steroids are capable of inhibiting the oxygen uptake of rat brain homogenates. It was found that testosterone inhibits the oxidation of glucose at some point preceding participation of the cytochromes in "the main line of

biological oxidation'' (*2*). In an attempt to determine whether or not testosterone is concerned with normal oxidative mechanisms, we have compared the respiration of tissues of castrated rats with the respiration of tissues of normal and testosterone-treated castrated rats.

TABLE 1

	Number of animals	Body weight gm ± σm*	Weight brain mgm ± σm	Weight brain per 100 gm body weight	Mean QO_2 first 90 min μl ± σm	Final QO_2 180 min (no testosterone) μl ± σm	Final QO_2 180 min (testosterone added at 90 min) μl ± σm	Inhibition of QO_2 produced by testosterone	Wet/dry ratio
Normal	12	182 ± 8.1	1206 ± 29	663	6.5 ± 0.1 (35)†	4.3 ± 0.1 (25)	1.5 ± 0.1 (10)	65%	4.9
Castrate untreated	16	161 ± 4.1	1152 ± 21	716	8.6 ± 0.1 (72)	6.8 ± 0.1 (30)	5.3 ± 0.1 (42)	22%	4.7
Castrate treated	13	166 ± 8.3	1094 ± 26	659	6.9 ± 0.1 (80)	5.4 ± 0.1 (28)	2.6 ± 0.1 (52)	52%	4.7

* σm—Standard deviation of the mean.

†—Number of vessels in parentheses.

Male rats of the Long-Evans and Slonaker-Wistar strains were used. There were no significant differences between data derived from the two strains and therefore the results were pooled. Tissue respiration studies were performed upon three groups of animals: a group of normal males, a second group castrated at the age of 30 days, and a third group castrated at 30 days and afterward treated subcutaneously with 1 mg of testosterone propionate[1] per day. The rats were decapitated at 60 days of age and the QO_2 of brain was determined by the direct method of Warburg. Cell suspensions of cerebral hemispheres were prepared by the method of Potter and Elvehjem (*6*) in ice-cold modified Krebs' Ringer-phosphate buffer containing 0.2% glucose as substrate. One ml of a 10% homogenate was placed in a Warburg flask containing sufficient buffer and material in the sidearm to make a final volume of 2 ml. The vessels were placed in a bath at 37.2° C within 10 min after decapitation. The gas phase was oxygen. Each experiment lasted 3 hr with readings taken at 15-min intervals. When testosterone was added *in vitro*, 2 mgm of a fine suspension was added after a 90-min control period. QO_2 is reported as μl of oxygen per mgm of dry brain per hr. Wet/dry ratios were determined by the method of Crismon and Field (*1*).

Experimental data are summarized in Table 1. It will be observed that the brain of the castrated rat has an oxygen uptake 32% higher than that of the normal rat (p value < 0.01). The brain of the castrated rat treated with testosterone respires at a rate only slightly higher than normal ($p < 0.01$). The addition of testosterone *in vitro* further suppresses the oxygen uptake of all groups; however, the inhibition is far less in the castrated than in either the treated castrated or the normal group.

[1] Grateful acknowledgment is made to Dr. E. Oppenheimer, Ciba Pharmaceutical Products, Inc., Summit, New Jersey, for the testosterone propionate (Perandren) and the unesterified testosterone used in this study.

It will further be observed that the QO_2 of the brain of the untreated castrated rat to which testosterone has been added *in vitro* (5.3) is essentially the same as that of the testosterone-treated castrated rat brain (5.4) at a comparable time. The rate of oxygen uptake by the brain of the treated castrated rat can be decreased to a still lower level (2.6) by the further addition of testosterone *in vitro*. The variations in QO_2 cannot be explained by difference in water content, since the wet/dry ratios of all groups are essentially the same.

Inasmuch as the potential enzymatic activity of certain tissues exceeds the actual activity found *in vivo*, the concept of the metabolic ''brake'' has been postulated (*4, 5*). It appears that testosterone exerts such a ''braking'' action upon the oxidation of glucose by the rat brain. This is borne out by the high QO_2 of the castrated rat brain and the prevention of the rise of QO_2 by testosterone treatment *in vivo*. The further addition of testosterone *in vitro* is capable of lowering the QO_2 to subnormal levels in normal and testosterone-treated castrates. This is not the case with untreated castrates. In other words, the brain of the castrated rat is less sensitive to the oxidation-inhibiting effect of testosterone *in vitro* than is the brain of the normal rat or of the castrated rat treated with testosterone. A possible interpretation is that the intracellular concentration of the enzyme system by which testosterone exerts its inhibiting effect upon the oxygen uptake of brain is decreased after castration. This decrease can be prevented for the most part by the administration of testosterone.

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Comments and Communications

Glycine Reagent for Paper Chromatograms

Glycine on a paper chromatogram can be identified as Hellebore green spot, chocolate brown under radiation the region of 3650 A, by spraying with a solution of rtho-phthalaldehyde, previously described by the senior uthor as a colorimetric reagent (A. R. Patton, *J. biol. hem.*, 1935, **108**, 267). Interfering substances present protein hydrolyzates (particularly ammonium ions) are ispersed by using 77% ethanol as the solvent mixture. Aromatic solvent mixtures produce abnormal reactions. Ve have found ethanol to be satisfactory for ascending eparation in a range between 65 and 85% by volume, nd 77% ethanol $\left[\text{sp. gr. } 0.87 \frac{60^\circ \text{ F}}{60^\circ \text{ F}}\right]$ the most suitble.) Rf values for individual amino acids with ascendng irrigation on Whatman No. 1 paper were measured ith ninhydrin as follows: cystine 0, lysine .21, arginine 26, aspartic acid .28, histidine .29, glycine .32, serine 7, tryptophan .38, glutamic acid .39, tyrosine and ydroxyproline .43, threonine .45, alanine .49, proline .55, ethionine .64, phenylalanine .65, valine .68, leucine .76, oleucine .77, and ammonium ions .57 (developed with lycine reagent).

In addition to identifying glycine, use of the reagent ermits detection of ammonium ions (dark grey), and istidine and tryptophan (separate spots, intense yellow uorescence under radiation around 3650 A). Among he compounds tested which cannot be detected by use f the glycine reagent are alanine, arginine, asparagine, spartic acid, choline, creatinine, cystine, glutamic acid, lutamine, glutathione, glycine-betaine, hydroxyproline, soleucine, leucine, lysine, methionine, nor-leucine, phenylalanine, proline, serine, threonine, tyrosine, and valine.

The method has been found satisfactory for the detection of glycine in the hydrolyzates of casein (low in glycine), gelatine (high in glycine), pilchard protein, Vegamine (a hydrolyzed plant protein), as well as in a mixture of 18 amino acids. Out of three commercial samples of hydroxyproline tested, one was found by this method to be contaminated with glycine.

The glycine reagent is apparently not yet available on the market. For the sample used we are indebted to Charles D. Hurd, Northwestern University. This sample was prepared as follows: 10 g o-bis(dibromomethyl) benzene was hydrolyzed according to the directions of Patton (*J. biol. Chem.*, 1935, **108**, 267) with 9 g potassium oxalate, 62 ml each of water and 95% ethanol. The mixture was refluxed 41 hr with occasional shaking, after which 50 ml was distilled off, and added to 300 ml water containing 21.3 g trisodium phosphate dodecahydrate. The solution used as "glycine reagent" was obtained by distilling 300 ml from this mixture, melting out crystals as they appeared in the condenser. The colorless solution, stored in a brown bottle, was over 18 months old when used.

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Nomenclature of the Soybean

In the paper published recently by P. L. Ricker and W. J. Morse (*J. Amer. Soc. Agron.*, 1948, **40**, 190), the old question of the correct scientific name for the soybean was discussed again. According to the authors' point of view, *Glycine Max* (L.) is the name to be used for that plant. The authors base their arguments on the apparent fact that *Phaseolus Max* L. is the oldest specific name for the soybean. I wish to show later the status of this name. There is no doubt that Linnaeus' original description of *Phaseolus Max* in his *Species plantarum* (1753) has some specific characters derived from another element, namely *Phaseolus Mungo* L.; this may be proven by the reference to a name under *P. Max*, which was given to the plant, now being known under the name of *Phaseolus Mungo* L., by P. Herrmann in *Musaeum Zeylanicum* (1726). The majority of the botanists interested[1] consider *Phaseolus Max* L. to be identical with *Phaseolus Mungo* L. Furthermore, H. Trimen[2] proposed entirely to use the name of *P. Max* L. in favor of that of *P. Mungo* L.

Generally, the confused species *Phaseolus Max* L. would belong partially to the genus *Glycine*, partially to that of *Phaseolus*. On the other hand, the proper description of the soybean was made by Linnaeus under the name of *Dolichos Soja*, also in his *Species plantarum* (1753). On account of the above remarks it is evident that *Phaseolus Max* of Linnaeus must be considered as a *nomen confusum*. (*Int. rules of botanical nomencl., Art. 64*: "A name of a taxonomic group must be rejected if the characters of that group were derived from two or more entirely discordant elements, especially if those elements were erroneously supposed to form part of the same individual.") Because of increasing use of the invalid name for the soybean,[3] *Glycine Max* (L.) Merrill, instead of the correct denomination *Glycine Soja* (L.) Siebold et Zuccarini, I hope this note may be useful.

Jiří Paclt

Prague, Czechoslovakia

[1] Represented by W. Roxburgh (*Flora indica*, 1832).

[2] *Handbook of the flora of Ceylon*, 1894, **2**, 72.

[3] Quite recently, the incorrect name *Glycine Max* has appeared also in a number of standard handbooks, e.g. C. D. Darlington & E. K. Janaki Ammal: *Chromosome atlas* (1945).

Two Ancient Archeological Sites in the Great Basin

During the years 1936 to 1942 my late husband William H. Campbell and I spent considerable time studying two ancient archeological sites in the Great Basin: one on ancient Lake Tonopah in Big Smoky Valley, Nevada, the other on the long abandoned shores of Owens Lake, California and along the old river channel which drained it southward. In 1936 and 1939 Dr. Ernst Antevs took part in the field work with us.

At both places Folsom, Pinto, and Mohave artifacts were found segregated from each other. These types of artifacts are described in the following papers: Frank H. H. Roberts, "A Folsom Complex: Preliminary Report on Investigations at the Lindenmeier Site in Northern Colorado," *Smithsonian misc. Coll.*, 1935, **94**; *idem*, "Additional Information on the Folsom Complex," *ibid.*, 1936, **95**; Elizabeth and William H. Campbell, David Scharf and Charles Amsden, "The Pinto Basin Site," *Southwest Museum Papers* No. 9, 1935; Elizabeth and W. H. Campbell, Ernst Antevs, Charles Amsden, J. A. Barbieri and F. D. Bode, "The Archeology of Pleistocene Lake Mohave," *ibid.*, No. 11, 1937.

The Lake Tonopah Site is located west of the city of Tonopah on and just north of pluvial Lake Tonopah, mapped and described by E. O. Meinzer (*U. S. Geol. Survey*, Water-Supply Pap. 423, 1917). Here the artifacts were found on the surfaces of the beaches in the following descending order, or from older to younger: First, Mohave, second Folsom, third Mohave, fourth Pinto. Hence Mohave artifacts occur on both higher and lower beaches than the Folsom objects. Of Folsom implements there were hundreds gathered, mostly on a sandy ridge bordering Peavine Creek, which flows into the basin in wet years and on the adjoining gravel shores of the ancient lake. Typical specimens are pictured in "A Folsom Complex in the Great Basin, the Master Key," by Elizabeth and William H. Campbell, January 1940, pp. 7–11. Barring the deeply grooved Folsom points, everything found at Dr. Roberts' Lindenmeier Site was represented, and all other Folsom artifacts, including slightly fluted points, resembled in detail the tools from Lindenmeier. In Dr. Roberts' present view the assembly is not true Folsom, since it lacks the deeply fluted point, which he regards as the crucial criterion ("Evidence for a Paleo-Indian in the New World," *Acta Americana*, 1943, **1**, 171–201; see p. 173).

While the Folsom here could be associated with Peavine Creek, it seems more reasonable to associate it with the old lake features no later than the last great pluvial period, and the fact that there is no change in work tools precludes any great passage of time in its spread from the Great Plains to southern Nevada.

The site is of value for two reasons: first because of the presence and the relative distribution of Folsom and second because post-Pinto cultures occurring in the deeper parts of the basin show what followed the old complexes here, down to the recent Indian occupation.

At Owens Lake we have a series of beaches descending from the crest of a bar at 3,675 elevation, or 128 feet above the playa flat, to the lowest shore lines merging into the surface of the present bare playa. The crest stands some 85 feet below the old overflow channel at about 3,760 feet (H. S. Gale, in *U. S. Geol. Survey Bull.* 1915, **580**, 256).

On the crest we found Mohave artifacts extending for some miles across the north shore of the lake, while to the north and farther back from the lake, and possibly at a few feet lower level, were Pinto artifacts.

On the lake side of the crest the next lower and thus younger second beach was barren of artifacts. The third beach contained Folsom artifacts and although there was no such concentration of artifacts as occurred on the Nevada site, there was nothing found on this beach except Folsom. Thus the three types of artifacts were fully segregated, nowhere mixed.

Below the fourth beach there is a zone of sandhills which, occurring at this level nearly all the way around the lake, could have been blown up during the very arid period following the end of the last glacio-pluvial period. Above the sand dunes the beaches are tremendous in sweep and width, while below they are small and narrow. It is on these latter beaches that modern Indian arrowpoints and artifacts are found.

We followed the ancient continuation of the Owens River southward past Haiwee reservoirs, through the old gorge into Rose Valley, and below and through Rose Valley to Little Lake and China Basin beyond. We found good sites a mile or two north of Little Lake near the extinct volcano and around a dry waterfall worn by the old river.

Accordingly, with the exception of the deeply grooved Folsom points, the entire assemblage of artifacts found at the foremost Folsom site—the Lindenmeier in Colorado—have also been found on the pluvial Lakes Tonopah and Owens; and they occur on beaches at slightly different levels than do the Mohave and Pinto implements, which also are segregated.

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In Memoriam

William Thomas Shaw

1873–1948

William T. Shaw, professor emeritus of zoology at Fresno State College, was a naturalist who began an intimate association with the out-of-doors when he was a small boy in southern Ontario, Canada, and who continued to find in nature an all-absorbing interest until the end of his 75 years.

Only a few professional biologists today can be called naturalists. William T. Shaw was outstanding in this select group because of the completeness with which he devoted his life to the study of nature. He never married. During the 20 years of his residence in Fresno he owned no local property, and the time that men generally devote to their families, gardens, and golf he gave to biology.

Most of his waking hours were spent in teaching, writing, photography, and taxidermy, in the interests of his beloved Fresno Natural History Society, and in preparing a unique series of habitat cases (*Scientific Monthly*, Feb. 1945, pp. 97–107) which reproduce typical scenes across the middle of California. Even though he was always occupied with some job in biology, he was never too busy to mount, with rare skill, a bedraggled specimen brought in by a Boy Scout, or to welcome a shy little girl who wanted to see his pet kangaroo rats.

Time and again I urged him to write the story of his 65 years as a student of nature. It would have made good reading—his 100-mile voyage down the Mississippi River in a birch-bark canoe ('95); his work as an undergraduate in Minnesota under the entomologist, Otto Lugger, at 10 cents an hour ('94–'98); his field trips, many of them with distinguished companions; the successful careers of his students; his collecting for the Museum at Oregon State College; his bird-collecting adventures in Alaska ('07 and '08) and experiences in exhibiting the collection at the Alaska-Yukon-Pacific Exposition ('09); his long service as curator of the Connor Museum at Pullman, Washington; his work at the New York State Museum ('27), mountain climbing, and ranching in Saskatchewan. Well, he would say, he might write the story someday, but right now there was too much to be done that was more important. There was that long manuscript on the birds of Washington (by Walter P. Taylor, William T. Shaw, Stanley G. Jewett, and John W. Aldrich) to read over again, and his monograph on the Columbian ground squirrel must be completed. My insistence got me nowhere except to a surer realization that it was no use trying to influence the plans of William Thomas Shaw.

Nearly all of his life he had college loyalties: to the Ontario Agricultural College, where his father, Professor Thomas Shaw, was a teacher of agricultural subjects; to three institutions where he earned degrees—the University of Minnesota (B.Agr. '98, B.S. '99), Michigan State College (M.S. '00), and Stanford University (Ph.D. '26); and to Iowa State College, Oregon State College, the State College of Washington, the University of Redlands, and Fresno State College, where he taught. His teaching included zoology, ornithology, entomology, museum management, taxidermy, bacteriology, and botany.

All who knew William T. Shaw admired his determination. A slender, fairly tall man, he was forced to walk with a cane because of a leg crippled by infantile paralysis when he was less than a year old. In spite of this handicap he climbed mountains, explored marshes and tide pools, and trapped along rugged streams, all with never a complaint. His halting gait was slow but persistent, and as often as not he was among the first in the party to reach the summit of a climb.

Dr. Shaw's boyhood in Woodburn and Guelph, Ontario, was spent in the same region where Ernest Thompson Seton lived during his early years as a farm boy. Seton, John Muir, John Burroughs, and Donald Culross Peattie were his favorite authors. At its best his own prose was of high quality. His last letter to me, written during the final summer in Saskatchewan, contained the following paragraph:

> Last week it was reported that the Cree Indians were celebrating their Sun Dance, which takes place near here. On invitation I went over, little suspecting to come suddenly upon a very memorable sight. It was evening, and, as we came to the crest of a hill, beyond and below us was a sight to remember. In a great circle lay over a hundred and sixty tepees and tents, with a great ceremonial space within. To one side lay a distant coulee tinted with evening glow, and from the camps and tepees rose grey, vertical columns of smoke. To us there arose the chant of the dancers and, what seemed best of all, the treble voices of children all over the huge circle. What a farewell to day! As dusk closed in there came distantly the call of a lark singing.

PEREZ SIMMONS

Fresno, California

Scientific Book Register

COLE, LEWIS GREGORY. *Lung dust lesions (Pneumoconiosis) versus tuberculosis.* White Plains, N. Y.: American Medical Films, 1948. Pp. xxii + 474. (Illustrated.) $10.00.

DEGOWIN, ELMER L., HARDIN, ROBERT C., and ALSEVER, JOHN B. *Blood transfusion.* Philadelphia-London: W. B. Saunders, 1949. Pp. xii + 587. (Illustrated.) $9.00.

DUSHMAN, SAUL. *Scientific foundations of vacuum technique.* New York: John Wiley; London: Chapman & Hall, 1949. Pp. xi + 882. (Illustrated.) $15.00.

GALLET, ETIENNE. *Die Flamingos der Camargue.* Thun, Switzerland: Werner Krebser, 1949. Pp. 127. (Illustrated.)

GITHENS, THOMAS S. *Drug plants of Africa.* (African Handbooks: 8, Committee on African Studies, University of Pennsylvania.) Philadelphia: Univ. Pennsylvania Press, 1949. Pp. vii + 125. $2.25.

HELLMAYR, CHARLES E., and CONOVER, BOARDMAN. *Catalogue of birds of the Americas and the adjacent islands in Field Museum of Natural History: Charadriiformes,* Pt. 1, No. 3. (Publ. 616.) Chicago: Field Museum, 1948. Pp. vi + 383. $4.00.

HONEYMAN, JOHN. *An introduction to the chemistry of carbohydrates.* Oxford, Engl.: Clarendon Press; New York: Oxford Univ. Press, 1949. Pp. 143. (Illustrated.) $4.50.

KUIPER, GERALD P. (Ed.) *The atmospheres of the earth and planets: papers presented at the Fiftieth Anniversary Symposium of the Yerkes Observatory, September, 1947.* Chicago: Univ. Chicago Press, 1949. Pp. vii + 366. (Illustrated.) $7.50.

MITCHELL, JOHN JR., and SMITH, DONALD MILTON. *Aquametry: application of the Karl Fischer reagent to quantitative analyses involving water.* New York: Interscience, 1948. Pp. xi + 444. (Illustrated.) $8.00.

MONTGOMERY, D. J. X. *Cosmic ray physics.* Princeton, N. J.: Princeton Univ. Press, 1949. Pp. viii + 370. (Illustrated.) $5.00.

SCHOLES, FRANCE V., and ROYS, RALPH L. *The Maya Chontal Indians of Acalan-Tixchel: a contribution to the history and ethnography of the Yucatan Peninsula.* (Publ. 560.) Washington, D. C.: Carnegie Institution, 1948. Pp. x + 565. (Illustrated.) $3.50 paper; $4.75 cloth.

SICHER, HARRY. *Oral anatomy.* St. Louis, Mo.: C. V. Mosby, 1949. Pp. 529. (Illustrated.) $15.00.

SILVER, SAMUEL. (Ed.) *Microwave antenna theory and design.* (Massachusetts Institute of Technology Radiation Laboratory Series.) New York: McGraw-Hill, 1949. Pp. xviii + 623. (Illustrated.) $8.00.

WOGLOM, WILLIAM H. *Discoverers for medicine.* New Haven, Conn.: Yale Univ. Press, 1949. Pp. x + 229. (Illustrated.) $3.75.

(Continued from page 328.)

calibration exposures with the abscissa expressed in terms of the log of the fractional dosage. By fractional dosage is meant the ratio of the dosage rate in the calibration source to the bone dosage rate which would have existed had the bone been formed from the blood calcium at the instant of its highest specific activity. (It is assumed here that the *maximum* calcium concentration in bone is 36 percent by weight, the measured concentration in bone ash [*4*].) The blackening for each bone site labeled in Fig. 1 is indicated on the vertical scale of Fig. 2, from which it is seen that the maximum fractional dosage in the dog rib, corresponding to sites 2 and 3, is the antilog of $\overline{2}.26$, or .018.

The importance of this fact is its application to the possible use of radioactive Ca^{45} as a tracer in human beings. If such an experiment is to be carried on with reasonable convenience, this isotope will have to be present in the blood in a concentration of at least 1 μc/gm Ca. If bone were formed directly from such calcium, the dosage rate would be a forbidden 1.9 reps/day (again assuming 36 percent maximum calcium concentration). However, if the same dilution existed in humans as in the particular dog rib studied, the maximum local dosage rate would be a permissible value of $(.018)(1.9) = 0.034$ reps/day. It is important to notice, however, that this maximum local dosage rate is approximately six times higher than the average rate in the bone as a whole as determined by counter measurements on the digested rib.

Further work is planned in the quantitative study of film characteristics for different types and energies of radiation, and in the development of calibration sources which can be cut simultaneously with soft tissue, using a microtome technique.

References

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2. BORRIES, B. v. *Physikalische Zeitschrift*, 1942, **43**, 190.
3. EVANS, R. D. *Amer. J. Roentgenology and Rad. Therapy*, 1947, **58**, 754.
4. SCHMIDT, C. L. A., and GREENBERG, D. M. *Physiol. Rev.*, 1935, **15**, 279.
5. YANKWICH, P. E., and WEIGL, J. W. *Science*, 1948, **107**, 651.

NEWS and Notes

1949 Annual Meeting of the AAAS. The 116th Meeting of the American Association for the Advancement of Science will be held December 26–31, 1949, in New York City. The Association has held only five meetings in this city—the last, 21 years ago. The other occasions in New York were in 1916, 1906, 1900, and 1887. The 115th Meeting commemorated the Association's Centennial, September 13–17, 1948, in Washington, whereas the last meeting during the Christmas holidays—the period preferred by a large majority of the members—was held in 1947 in Chicago.

All plans for 1949 are based on the assumption that this will be the largest gathering of representatives from the 17 sections and subsections and 206 affiliated and associated societies in the 101 years of the AAAS. It will undoubtedly be one of the most convenient meetings from the standpoint of all concerned. The Statler Hotel (formerly the Pennsylvania) will be the headquarters for the Annual Science Exposition, Main Registration, Visible Directory, New Member Service, and Science Theatre. Its four close neighbors, the New Yorker, McAlpin, Governor Clinton, and Martinique, have also pledged their public rooms for the convention period. Thus, related societies may be grouped together and it is probable that *most* of the papers will be read in rooms so close together that those who so desire can readily attend a variety of sessions. These Penn Zone hotels also have made commitments for 3,500 sleeper rooms, many of them double, so that adequate accommodations are assured. The New York Convention Bureau will handle all room reservations and hotels will send prompt confirmations directly. *Science* will announce soon which societies are meeting with the Association, and the hotels at which their meetings will be held. Advance registration and hotel room reservation will begin in September.

Frank A. Geldard, on leave of absence from the University of Virginia, has been appointed research chief of the Human Resources Branch, Division of Research and Development, Department of the Air Force, Washington, D. C.

Thomas Park, on leave of absence from the University of Chicago, has left for London, where he will be senior scientific officer of the American Embassy.

David Rittenberg, associate professor of biochemistry, College of Physicians and Surgeons, Columbia University, will deliver the seventh Harvey Lecture of the current series at the New York Academy of Medicine on April 28. His topic will be "Dynamic Aspects of the Metabolism of Amino Acids."

E. D. Friedman, staff member of New York University since 1909, was guest of honor at the Alumni Dinner of the University College of Medicine held recently.

Stanley Wing Handford, Brown University, has been named senior physiologist at the Naval Medical Field Research Laboratory, Marine Barracks, Camp Lejeune, North Carolina, April 1.

Recently appointed members of the permanent U. S. Atomic Energy Commission's Personnel Security Review Board are **Charles Fahy,** former Solicitor General of the United States, who will serve as chairman; **Arthur S. Flemming,** president of Ohio Wesleyan University; and **Bruce D. Smith,** director of the United Corporation, New York City. The Board will review individual personnel security cases, and advise the commission on personnel security standards and procedures.

Henry M. Leicester, professor of biochemistry at the College of Physicians and Surgeons, San Francisco, has been named to succeed the late Tenney L. Davis, as editor-in-chief of *Chymia: annual studies in the history of chemistry.* **John Read,** director of the Chemistry Research Laboratory, University of St. Andrews, Scotland, is the new associate editor.

C. C. Burlingame, consulting psychiatrist, recently visited India on a speaking tour by invitation of the Indian Psychiatric Society. While there he addressed the All-India Medical Conference at its silver jubilee meeting in Calcutta, and the annual meeting of the Indian Science Congress in Alla Habad.

Irven Travis, former supervisor of research at University of Pennsylvania's Moore School of Engineering, has been appointed director of research of the Burroughs Adding Machine Company. Dr. Travis will continue to be a member of the university faculty.

Pablo Morales-Otero, director of Puerto Rico's School of Tropical Medicine, has been appointed to the medical faculty of Columbia University.

R. H. Wiswall, Jr., supervisor of research in physical chemistry for the Carbide and Carbon Chemical Corporation's gaseous diffusion plant at Oak Ridge, has recently joined the staff of Brookhaven National Laboratory in the Department of Reactor Science and Engineering.

Emanuel B. Schoenbach, Department of Preventive Medicine, Johns Hopkins University School of Medicine, will serve as visiting Commonwealth Professor of Medicine at the University of Louisville School of Medicine, April 17–23. He will present a series of discussions on "The Mechanism of Actions and Indications for the Newer Antibiotics," "The Treatment of Rickettsial Infections," and "Experimental Investigations on the Chemo-Therapy of Neoplasms."

Eugene Callaghan, Department of Geology, Indiana University, has been appointed director of the New Mexico Bureau of Mines and Mineral Resources Division of the New Mexico School of Mines, Socorro. He will take over his new duties in September.

Donald B. Keyes, vice president in charge of planning and development of the Heyden Chemical Corporation, New York City, will be presented with the first Honor Scroll of the New York chapter of the American Institute of Chemists, for his service and devotion to young chemists. He will receive

the award May 18, at a dinner meeting of the Institute.

Visitors

Miguel Catalan, professor of atomic physics at the University of Madrid, is guest lecturer at Wilson College this month. He is lecturing on physical problems and working with students in the department of physics on spectroscopy and atomic physics.

H. M. S. Coxeter, professor of mathematics of the University of Toronto, has been named visiting professor at Barnard College, Columbia University, for the spring session.

Grants and Awards

The Research Corporation Scientific Award was recently presented to Bruno Rossi, professor of physics at the Massachusetts Institute of Technology, for distinguished research in the fields of cosmic radiation and properties of mesons, and for his work in nuclear fission. Dr. Rossi received a plaque and $2,500.

The National Dairy Council, Chicago, has announced its 1949 research program, involving an expenditure of $75,000. Funds for the projects are provided either by the American Dairy Association, Chicago, or the National Dairy Council. Grants for nutritional research in the use of dairy products have been made to: Michigan State College, University of Chicago, University of Wisconsin, Iowa State College, Texas A. & M., University of Rochester, University of Illinois, University of Minnesota, University of Nebraska, Harvard University, and University of Massachusetts, and the University of Michigan.

The American Academy of Arts and Sciences has chosen Ira S. Bowen, director of the Mount Wilson and Palomar Observatories in California, as recipient of the 1949 Count Rumford medals, for discoveries in the fields of heat and light.

National Cancer Institute grants totaling $451,622 for cancer teaching and control have been announced by the Federal Security Agency. Nine control grants totaling $170,205 were approved. Three of these, amounting to $69,114, are new grants, to finance a state environmental cancer study in Pennsylvania and two cancer diagnostic test projects, at the University of California and the University of Colorado. Two new teaching awards were made, one of $23,339 to Vanderbilt University School of Medicine and one of $5,000 to the University of Southern California School of Dentistry.

The Royal Society of Edinburgh will award its David Anderson-Berry medal for 1950 to the person who, in the opinion of the Council, has recently produced the best work on the therapeutical effect of X-rays on human diseases. About £100 goes with the award. Both published and unpublished works are acceptable and should be accompanied by copies of relevant papers. Applications must be in the hands of the General Secretary, Royal Society of Edinburgh, 22 George Street, Edinburgh 2, Scotland, by March 31, 1950.

William C. Rose, University of Illinois, has been selected to recieve the first **Osborne and Mendel Award** of the American Institute of Nutrition. Professor Rose was associated with the two founders of the award at Yale.

The General Electric Company has awarded from its Educational Fund $18,460 in research fellowships to 15 graduate students for advanced study in scientific and industrial fields during 1949. Seven of the students received the Charles A. Coffin Fellowships, for study in electricity, physics, and the physical sciences. Eight others were awarded the Gerard Swope Fellowships, for study in industrial management, engineering, and the physical sciences. The winners received up to $1,500, plus a grant for special equipment needed in their chosen field.

Fellowships

The University of Rochester has established five three-year Bausch-Lomb scholarships to go to graduates of Puerto Rican high schools. Both boys and girls are eligible, and the scholarships amount to $1,500 each, to be used over the three-year period in study of the sciences.

The Watson Scientific Computing Laboratory at Columbia University announces two $2,000 fellowships in applied mathematics during the academic year 1949–1950, for study and research relating to large scale calculating operations. Application blanks may be obtained from the Office of Admissions, Columbia University, New York City, and must be returned before *April 15.*

Lehigh University announces the following fellowships available for the academic year 1949–1950: Two du Pont Company fellowships—one in mechanical, one in metallurgical engineering ($1,200 to $1,800); one Westinghouse fellowship in mechanical engineering ($1,000); and one George Gowen Hood fellowship in any field of work in which the University offers a doctorate ($1,500). Application blanks may be had by writing Dean Wray H. Congdon, Director of Admissions, Lehigh University, Bethlehem, Pennsylvania.

Battelle Memorial Institute offers a limited number of predoctoral research fellowships and postdoctoral research associateships for the year 1949–1950. The fellowships, open to men, U. S. citizens, seeking a doctor's degree in a science or in engineering, are available for the final year of graduate study. Fellows receive $1,200 a year, plus expenses. Preference for associateships will be given to men who hold the Ph.D. degree, and stipends will be determined by the associates' preparation, experience, and promise. Further information may be had by writing to the Institute, 505 King Avenue, Columbus 1, Ohio.

The **New York Zoological Society** announces a veterinary research fellowship of $500 for three months—June 15–September 15, at the New York Zoological Park. The recipient must have a veterinary degree from an American Veterinary Medical Association approved college, and show special interest in such fields as zoology, wildlife management, comparative anatomy, physiology, bacteriology, parisitology, and pathology. Applications should be addressed to Leonard J. Goss, Veterinarian, New York Zoological Society, Zoological Park, New York City 60.

Lehigh University has announced the establishment of a new **International Nickel Company** research fellowship for work in the fields of nickel, copper,

and the platinum metals. The first recipient of the $1,500 award will be named later this year and will start work in September in the University's department of metallurgy.

Research fellowships in mathematics and mathematical physics for the summer of 1949 and the academic year 1949–1950 are offered to qualified graduate students by the Institute for Numerical Analysis of the National Bureau of Standards, located at the University of California, Los Angeles. The research work, to be done at the Institute, will be aimed at methods for advancing the application of high speed automatic digital computing machinery. Stipends are based on full-time annual salaries of $2,294 for master's degree candidates, and $3,727 for doctoral candidates. Further information and application forms may be obtained from the Chief, Institute for Numerical Analysis, 405 Hilgard Avenue, Los Angeles 24.

Colleges and Universities

The University of Illinois Chemistry Department has been awarded $10,000 by the E. I. du Pont de Nemours Company for fundamental research. C. S. Vestling and B. R. Ray will be assigned $7,000 for research on the purification and characterization of the enzyme, rat liver lactase dehydrogenase. H. G. Drickamer will receive $3,000 for research on nuclei formation in the critical region between the gaseous and the liquid state.

The Ohio State University Development Fund has received a second gift of $1,000 from John W. Galbreath, of Columbus, for research, particularly on cancer, in the University's Department of Medicine. The study will be under the direction of Charles A. Doan, dean of the College of Medicine.

The University of Illinois College of Agriculture is investigating methods of killing bacteria in milk or water by use of ultrasonic waves. The research is being carried on by Robert M. Whitney, professor of dairy technology, and Lillian A. Russell, Illinois State Water Survey chemist. No reportable results are expected for at least a year.

Lehigh University Institute of Research, in cooperation with the David E. Kennedy Corporation of Brooklyn, New York, has obtained fundamental data supporting the performance of finned tubing as about eight times better than plain tubing in heat exchange applications. Darrel E. Mack is director of the project.

Construction will start on the **University of California's new medical center** during the spring of 1950, when two major buildings—a medical science building and a 500-bed teaching hospital—go up on the site of the present medical center, in San Francisco. A total of $21,080,000 is now earmarked for construction—$20,015,000 of state funds, $1,000,000 from the U. S. Public Health Service, and $65,000 donated by Mr. and Mrs. Berthold Guggenhime.

Harvard University has created a new Division of Engineering Sciences within the Faculty of Arts and Sciences in order to help bridge the gap between pure science and the technology of engineering. The new division, under the chairmanship of Gordon M. Fair, present dean of the Graduate School of Engineering, will consist of two departments. The Department of Engineering Sciences and Applied Physics will offer graduate training in applied mathematics, applied physics, and electrical and communication engineering, directed by Emory Leon Chaffee; and the Department of Engineering a graduate program in applied mathematics, civil, electrical, and sanitary engineering, directed by Albert Haertlein.

Industrial Laboratories

Albert D. Fisher, formerly technical director of Oxford Products, Inc., has been appointed head of the newly organized **Midwest Chemical Development Corporation,** Cleveland Ohio, manufacturers of pharmaceutical products. I. Levis, former faculty member of Case Institute of Technology and Fenn College, will be vice president in charge of research and production.

Schenley Laboratories, Inc., has announced that large scale production and marketing of streptomycin will soon begin at its Lawrenceburg, Indiana plant. Schenley is also reducing prices 10 to 25 percent on three penicillin products. This is the third such reduction in a year affecting the pure crystalline penicillin and its compounds aquacillin and monocillin. The wholesale price is now less than one-eighth that of March 15, 1945.

Smith, Kline & French Laboratories, 108-year-old pharmaceutical manufacturing firm, opened a new $7,000,000 building at 15th and Spring Garden Streets, Philadelphia, on March 12. The new building and grounds occupy a full city block and the space given to scientific research has been increased five times over that provided by former quarters. To carry new therapeutic agents progressively from chemical synthesis through animal testing, pharmacy, and bacteriology, the laboratories have been designed so that organic chemistry, pharmacology, research analytical and biochemistry laboratories are grouped on the fifth floor and pharmaceutical chemistry, bacteriology, and physical chemistry on the fourth.

Meetings and Elections

Stanford University School of Medicine announces its 67th course of **Popular Medical Lectures** to be held at Lane Hall, San Francisco, April 6, April 20, and April 27 at 8:00 p.m. Subjects of the lectures are: "Cancer of the Uterus," "Poliomyelitis: Means of Spread and Control," and "The Prevention and Treatment of Blindness in Childhood." All interested are invited to attend.

The **Institute of Mathematical Statistics** will hold its 38th meeting at Columbia University April 8–9. "Applications of Multivariate Analysis" will be discussed by John Wishart, Cambridge University; Harold Hotelling, University of North Carolina; and S. N. Roy, Presidency College, Calcutta.

The 16th International Geographical Congress will meet in Lisbon April 8–15. Members of the official U. S. delegation representing the National Research Council are: George B. Cressey, chairman; Wallace W. Atwood, Jr., S. W. Boggs, Edwin J. Foscue, Otto E. Guthe, S. Van Valken-

burg, and John K. Wright. The American delegation will present a number of proposals for new commissions, dealing with the International Map of the World, standardized spelling for place names, and the development of tropical areas.

The **Acoustical Society of America** will hold its 20th anniversary meeting May 5–7, at the Statler Hotel in New York City. Among the invited speakers are Philip M. Morse, Massachusetts Institute of Technology; Vern O. Knudsen, University of California at Los Angeles; and Harry F. Olson, RCA Laboratories. The research to be reported at the meeting will be grouped according to its function in relation to man, as follows: acoustics in comfort and safety, as a tool in physics, in the arts, and in communication. Those wishing to attend may obtain further information from Harold Burris-Meyer, Stevens Institute of Technology, Hoboken, New Jersey.

The International Association for Dental Research's New York Section will hold its May meeting at the New York University College of Dentistry on May 5. Members and guests wishing to present papers should communicate with the Secretary of the Association, 209 East 23rd Street, New York City 10.

The **Ohio Academy of Science** will hold its 58th annual meeting at Denison University, Granville, Ohio April 21–23. George B. Barbour, University of Cincinnati, will give the presidential address on the topic, "Ape or Man? The Recent Discoveries in South Africa."

Dana Coman, scientific advisor to the War Department General Staff, has been elected president of the **American Polar Society.** Vice presidents elected were: Laurence M. Gould, president of Carleton College; Thomas C. Poulter, director of Stanford Research Institute; and Finn Ronne, U.S.N.R., of Washington. All are polar expedition veterans. Russell J. Walrath, New York Times, was re-elected treasurer, and August Howard of New York, was again chosen secretary.

The **National Bureau of Standards** will hold two symposia on the effective utilization of automatic digital computing machinery, both at the Bureau's Institute for Numerical Analysis in Los Angeles: Symposium I: "Construction and Applications of Conformal Maps," tentatively planned for June 24–25; Symposium II: "Probability Methods in Numerical Analysis," tentatively planned for June 27–29.

Deaths

Vincente Inglada Ors, 70, geophysicist and chief of the Spanish Seismological Service, died January 9.

Herbert H. King, 66, professor and head of the Chemistry Department, Kansas State College, from 1918 until his retirement in 1948, died in Manhattan, Kansas on March 11.

Samuel F. Hildebrand, 65, ichthyologist, died suddenly on March 16 in Washington, D. C. Dr. Hildebrand had served as director of the U. S. Fisheries Laboratory in Beaufort, North Carolina, as an ichthyologist for the Department of the Interior, and more recently as a staff member of the Smithsonian Institution.

George Burr Richardson, 76, senior geologist of the U. S. Geological Survey from 1900 until his retirement in 1942, died March 18 in Washington, D. C.

Cleveland Norcross, 37, general manager of the American Institute of Physics, died March 21 in New York City after an emergency operation for a brain tumor.

Harvey C. Rentschler, 67, visiting professor of engineering at Princeton University and retired research director of the Westinghouse lamp division, died in East Orange, New Jersey on March 23.

The first Military Government German Industrial Exhibition will be held at the Museum of Science and Industry, Rockefeller Center, New York City, April 9–24 under the auspices of the U. S., British, and French Military Governments. Aimed at re-introducing the peacetime products of western Germany to American purchasers, the Fair will have over 500 exhibits displaying a variety of imports, including X-ray equipment, textiles, precision instruments, photographic apparatus, pharmaceuticals, electrotechnical and optical products and dental apparatus. The public is invited to attend the Fair any day from 1 p.m. to 10 p.m. Between 10 a.m. and 1 p.m. Monday through Friday, the exhibit is open to buyers exclusively.

The Army Medical Service Corps has a number of vacancies in the grades of 2nd and 1st lieutenants in the following specialties: bacteriology, biochemistry, parasitology, serology, entomology, nutrition, toxicology, industrial hygiene, optometry, psychiatric social work, clinical psychology and sanitary engineering, under the provisions of the Department of Army Circular 210, dated July 14, 1948. Further information may be obtained from the National Military Establishment, Department of the Army, Office of the Surgeon General, Technical Office, Washington 25, D. C.

The Unified Screw Thread system agreed upon by Great Britain, Canada, and the U. S. by the Declaration of Accord signed last November in Washington, has recently been given final approval by the American Standards Association. A detailed analysis of the new system has been made, presenting in tables, diagrams and formulas the dimensions of the unified threads, and also those threads which at present are standard in the U. S. alone. This analysis B1.1–1949 "Unified and American Screw Threads for Bolts, Nuts, and Other Threaded Parts" may be had by writing the American Standards Association, Inc., 70 E. 45th St., New York City 17.

Make Plans for—

American Association of Physical Anthropologists, April 11–13, Wistar Institute, Philadelphia, Pennsylvania.

1949 Conference of Corrosion Engineers, April 11–14, Cincinnati, Ohio.

6th Western Metal Congress and Western Metal Exposition, April 11–15, Shrine Convention Hall, Los Angeles.

Electrochemical Society, April 13–16, Philadelphia, Pennsylvania.